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Health Problems of Significance for Course and Curriculum Construction

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(Submitted for publication January, 1949)

A MAJOR difficulty which is faced by every health educator, whether he is teaching hygiene as a separate course, in an integrated program, or in a combination of these two administrative approaches, is that of determining curriculum content. Specialists in educational psychology have indicated for some time the wisdom of basing learning experiences upon the *interests* and *needs* of the student.

Contributions in the exploration of health interests and health needs as a basis for curriculum construction have been made by Oberteuffer (1), Lerrigo (2), Cairns (3), and others, including the Department of Instruction of the Denver Public Schools (4). Lantagne's unpublished dissertation (5) is also a significant study in this field and is summarized in part in the accompanying article. The present study, then, does not represent a pioneering effort in curriculum construction in health, but is offered only as additional data on an important and practical problem.

The determination of significant health problems is not a simple matter, but it is essential if health educators are to apply the principles advocated by educational psychologists. For example, a simple measuring instrument is needed if student health interests are to be explored. This instrument must have both validity and reliability. To have validity it must be broad enough to be a very good statistical sample of the health problems existing in our society today.

The determination of health interests and needs cannot be left to student discretion entirely, for an inadequate and even trivial expression of interests may be the result since the pupil may be entirely unaware of future and even current health needs, and his interests may be largely undeveloped. It should be apparent that for curriculum construction in health some guidance is needed as to what are the significant health problems around which learning experiences can be built by the instructor and his pupils.

Since 1943 the author has been publishing an annual summary of leading health problems and developments as represented by articles on health which have appeared in medical, public health, and allied scientific journals (6). It may be assumed that when health problems are being discussed in written articles in the professional

literature, they are not trivial or insignificant. Therefore, such published materials should have value for the health educator, curriculum specialist, or others involved in the determination of the scope of health in the curriculum.

The following list of 21 major health-problem areas contains 300 subdivisions consisting of specific health problems of varying significance. This list of 300 was prepared from the subject-matter of over 10,000 scientific and public health articles appearing in medical, public health, and allied scientific journals from 1942 to 1948. The list should be interpreted as a statistical sample, rather than an inclusive recording, of health problems currently discussed in public health and medical journals.

The list may be used by the instructor to explore student health interests by merely requesting each pupil to encircle the number of each specific health factor or problem which he would like to have included in the course content. A tabulation of results and ranking of group choices in terms of frequency of selections should point up quite clearly the leading health interests of any given group of students.

In an article by Dr. Joseph Lantagne, also appearing in this issue, an example of the use of this checklist for the exploration of the health interests of 3,000 high school students is given. Explorations of health interests on the college level are currently under way at Stanford University and some other educational institutions.

MAJOR HEALTH PROBLEM AREAS

1. HEALTH AS A SOCIAL ACCOMPLISHMENT
   - 1.1 Life expectancy in other countries
   - 1.2 Life expectancy in the United States
   - 1.3 Conquest of diseases
   - 1.4 Death rate trends
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   - 1.6 Infant and maternal mortality
   - 1.7 World food and medical relief
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2. HEALTH AS A SOCIAL PROBLEM
   - 2.10 Major health problems
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   - 2.12 Soil depletion and health
   - 2.13 Housing and health
   - 2.14 Overpopulation and health
   - 2.15 Atomic warfare
   - 2.16 River pollution and health
   - 2.17 Health problems of migrant workers
   - 2.18 Health problems of the Negro

3. Nutrition and Health
   - 3.19 Health hazards with foods
   - 3.20 Importance of minerals
   - 3.21 The vitamin problem
   - 3.22 Health aspects of protein
   - 3.23 Fats in human nutrition
   - 3.24 White bread and epilepsy
   - 3.25 World food conferences
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   - 3.28 Cooking and food values
   - 3.29 Nutrition and body weight
   - 3.30 Facts about milk
   - 3.31 Nutrition deficiencies
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   - 3.33 Practical selection of foods
   - 3.34 Effects of storing, freezing, canning, and dehydrating on food values.

4. Excretion and Health
   - 4.35 Laxatives and appendicitis
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   - 4.37 Diarrhea and its significance
   - 4.38 Significance of urinalysis
   - 4.39 Intestinal production of vitamins
   - 4.40 Kidney and urinary diseases
   - 4.41 Diseases of intestines
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   - 4.43 Mineral oils in food and health
   - 4.44 Worm infections as world problems
   - 4.45 Kidney and urinary stones
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5. Exercise and Body Mechanics
   - 5.47 The problem of physical unfitness
   - 5.48 Military drill vs. physical education
   - 5.49 Sports vs. apparatus activity
   - 5.50 Exercise and convalescence
   - 5.51 Exercise and menstruation
   - 5.52 Age and capacity for exercise
   - 5.53 Work and nutrition requirements
   - 5.54 Good posture
   - 5.55 Can a person exercise too much?
   - 5.56 Paralysis from crossing the legs
   - 5.57 Posture and tuberculosis
   - 5.58 Is there an "athletic heart"?

6. Fatigue and Rest
   - 6.59 Fatigue as a health problem
   - 6.60 Fatigue in industry
   - 6.61 Optimum working hours
   - 6.62 Health resorts
   - 6.63 Nervous fatigue
   - 6.64 Battle fatigue
   - 6.65 Ways of overcoming fatigue
   - 6.66 Rest for children

6.67 Ways of getting to sleep
6.68 Medically prescribed vacations
6.69 Rest and tuberculosis
6.70 Fatigue caused by disease
6.71 How to relax
6.72 Fatigue fractures

7. Mental Health and Disease

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7.74 Causes of suicide
7.75 Mental disorders in armed forces
7.76 Types of mental disorders
7.77 Retardation of mental decline
7.78 Psychological basis of crime
7.79 Hazards of high I.Q.
7.80 Psychological warfare
7.81 Prevalence of emotional disorders
7.82 National Mental Health Act
7.83 Mental hygiene in infancy
7.84 Jealousy
7.85 Mental hygiene of normal persons
7.86 Prevention of mental illness

8. Heredity and Eugenics

8.87 Is cancer hereditary?
8.88 Diabetes and heredity
8.89 Is epilepsy inherited?
8.90 Allergy and heredity
8.91 The Rh blood factor
8.92 Heredity and high blood pressure
8.93 Practical eugenics
8.94 Medical genetics
8.95 Medical disease and heredity
8.96 Hereditary aspects of rheumatic fever

9. Infection and Immunity

9.97 Diphtheria
9.98 Gamma globulin and its value
9.99 Handshaking and disease
9.100 Leading communicable diseases
9.101 Pneumonia and influenza
9.102 Tuberculosis
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9.104 Insects and disease
9.105 DDT and disease control
9.106 Venereal disease
9.107 Prevention of infections
9.108 Whooping cough
9.109 Blood testing program in Alabama
9.110 Sulfa and penicillin
9.111 Pneumatic fever
9.112 Bacterial warfare
9.113 Desirable immunization
9.114 Smallpox
9.115 Influenza and pneumonia

9.116 Other specific communicable diseases
9.117 Vaccination against influenza
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9.120 Infectious hepatitis (infection of liver)
9.121 Encephalitis (brain inflammation)

10. Chronic and Degenerative Disorders
10.122 Heart disease and public health
10.123 Cancer
10.124 The ulcer problem
10.125 Cancer preventative clinics
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10.128 Varicose veins
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11.131 Tobacco and human health
11.132 Treasury Department and anti-narcotics
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11.136 Problems of alcohol
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11.139 Hazards of barbiturates (sleeping drugs)

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12.140 Problems of dental decay
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Individual Differences in Foot Leverage In Relation to Jumping Performance[1]

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(Submitted for publication, August, 1949)

INTRODUCTION

DURING the past few years, coaches and sports enthusiasts have asked the question, "Just what is it in the make-up of one athlete that makes him jump higher than his teammates?" We assume that differences in body structure, physiological factors, and psychological factors all play an important role as a basis for deriving an answer to this question. The writer is primarily interested in differences in body structure.

Some work has been done in the past on anthropometric measurements in relation to success in jumping. Krakower (1), in attempting to answer the question, "Should coaches select men for training in high jumping in terms of physical stature?" secured various anatomical measures on 600 men and analyzed the data to discover what factors, if any, might be helpful in predicting success in the high jump. Anthropometric measures thought to have the greatest bearing on ability in the running high jump were chosen for study on the basis of the opinion of track coaches. The items selected were weight, height, length of legs, breadth of foot, and girth of hips.

He found that long legs were advantageous, the correlation between leg length and jumping ability being $r = .25$ to $.37$, although the correlations between skeletal measures and jumping were too small to be used for predictive purposes. Track athletes were found to be long-legged and short-trunked, compared to the unselected group.

Bernstein (2) has published a brief report of a study directed by H. W. Campbell on the importance of the foot-lever system in relation to jumping. A group of 120 track men, classified according to their events, was compared with a group of 2,000 non-athletes from the physical education classes in order to determine structural

[1] From the Research Laboratories of the Department of Physical Education, University of California, Berkeley.

differences among the various groups involving the foot lever. Negroes were measured separately to examine their apparent superiority in track events.

Campbell's theory was that the heel-to-ankle measurement and not the length of the tendon of Achilles is the factor that determines a man's spring. In computing the heel-to-ankle measurement among the different types of track men, evidence was found that the athletes who needed spring in their events had a large heel-to-ankle measurement. The Negroes had a mean measurement of 2.75 inches as compared with 2.68 inches for the white jumpers and 2.40 inches for the non-athletes. No statistical analysis of significance or correlation was made.

Although the Negro had the longest heel-to-ankle measurement, he also had the longest foot, 10.8 inches compared to 10.5 inches for the sprinters; 10.6 inches for the white jumpers and 10.4 inches for the non-athlete. Thus, the advantage, if any, would depend on the ratio of the heel-to-ankle length over the total foot length. In working out this calculation, it was found that the Negro had a ratio of 25.5 compared with 25.4 for the sprinters; 25.3 for the jumpers; 24.5 for the track men as a whole; and 23.1 for the non-athlete.

Thus, if Campbell's theory is a valid one, we would assume the following hypothesis: The athlete with the largest ratio between the heel-to-ankle (malleolus) length over the total foot length has a definite physical and mechanical advantage in driving his body as in sprinting and jumping where the body must be lifted off the ground.

Whereas Campbell states that the advantage in jumping would depend upon a relatively long heel-to-ankle length, Howell (3, pp. 31 and 39) concludes that jumping specialization among the rodents and other animals culminates in a disproportionate lengthening of the hind limbs, chiefly the distal elements. This is especially noted in kangaroos, who according to Howell have negotiated leaps of 26 feet or better in a single leap and who have been known to clear a fence nine feet high. Howell's theory of specialization in jumping animals would lead to the expectation that a relatively long metatarsal foot, i.e., a *short* heel-to-ankle length, would be most effective in jumping. The findings of Krakower as to the relative leg length of his track squad agree with the Howell theory.

The present study seeks to substantiate or disprove (a) Campbell's hypothesis that the "power" type of foot lever is advantageous in jumping performance, and (b) another hypothesis based on Howell's theory of jumping specialization in animals, namely that the long metatarsal foot or speed type of foot lever is advantageous in jumping.

METHODOLOGY

Subjects.—In this study, 47 track athletes at the Delano Joint Union High School served as subjects. Eight of these subjects were out for track for their first year; 20, out for their second year; 15, out for their third year; and four, out for their fourth year. No single subject was considered to possess outstanding, general all-round athletic ability. All subjects had completed a doctor's physical examination and were considered to be normal.

Techniques of Measuring the Foot.—All measurements were made with the subject sitting in a chair and in bare feet. The experimenter sat in a chair opposite the subject and holding the subject's foot in his lap, marked the points on the foot to be measured with an ordinary fountain pen. The subject was asked to extend and flex his ankle joint slowly so that the center of rotation of both the medial and lateral malleolus could be determined and marked by the experimenter. After the marks had been placed on the subject, he was asked to continue this flexion-extension action to ascertain that the mark was as close to the center as could be determined. This same method of measuring was used in determining the metatarsal-phalangeal point.

After the marks had been determined on both feet, the subject was asked to place the right foot in a specially designed piece of apparatus for taking certain foot measurements. The center of the heel was placed on a line drawn on the base of the apparatus and the second toe was placed on this same line, thus dividing the medial and lateral longitudinal arch of the foot.

Differences in the heel-to-ankle measurement among individuals can be attributed somewhat to differences in the amount of fat pad present posterior to the calcaneus. In order to eliminate this factor as much as possible, the apparatus was designed so that the backboard, against which the subject placed his heel, could be moved back from a set forward position against the resistance of two springs. A line was drawn parallel to the backboard on the base and the experimenter shoved the backboard back to this line before the subject was asked to place his foot in the correct position for measuring as described above.

This constant amount of pressure as exerted by the backboard was equal for all subjects. The writer felt that this pressure would push the backboard against the calcaneus and thus eliminate to some degree the differences that might have occurred in the heel-to-ankle measurement as a result of this added fat pad.

The subject was asked to put all his weight on the foot that was being measured with the opposite foot resting lightly on a platform about two inches in height. The subject stood in an erect position and the writer lined up the subject's lower leg to some vertical ob-

ject in the room to assure that it was in a correct vertical position before measuring began.

A heavy celluloid right triangle with a metric scale on both the front and back of one of its sides was inserted along the base board to the desired point to be measured. The readings were then taken from the metric rulers located on both sides of the foot. These metric rulers were attached to the backboard and moved back with the backboard when pressure was exerted on the backboard before the subject placed his foot in the measuring position as described above.

The measurements of the foot taken included the heel-to-ankle (both medial and lateral malleolus) measurement, heel-to-metatarsal-phalangeal measurement, total foot length, and height of the medial malleolus. These measurements were taken on both the right and left foot and were recorded in metric units. The weight of the athlete was also recorded.

The writer selected for study three types of jumps which involve jumping horizontally and vertically. These were:

1. The Sargent standardized vertical jump.
2. The ordinary track and field high jump (scissors style).
3. The standing broad jump.

Sargent Jump.—The Sargent jump, originated by D. A. Sargent in 1921, is a test of neuromuscular efficiency involving strength, speed, coordination, and driving power. In the present study, the jump was measured with a simple device designed by Henry.* A head-piece was constructed of woven fabric straps, with buckles placed to permit adjustment of both vertical and horizontal circumferences. A light-weight, non-stretching braided cord was attached to the head-piece and passed over a light-weight laboratory pulley rigidly suspended 15 feet above the subject. From the upper pulley, the cord passed through a second pulley mounted on the wall in the vertical plane and then to an automatic fly-casting fishing reel which was attached to a board fastened vertically to the wall. A piece of adding-machine tape was attached by means of scotch tape to the vertical board. A marker of white adhesive tape approximately three millimeters wide was wrapped around the cord approximately 30 inches above the reel with the subject standing in an erect position.

With the subject standing in an erect position just before each jump, a mark was made on the adding machine tape corresponding to the white adhesive tape marker and marked No. 1. As the subject leaped upward, this adhesive marker on the cord descended toward the reel. When the subject reached the maximum height of his jump, the marker on the cord reached its lowest point at this same instant. At this lowest point, the experimenter marked the spot on the record-

* F. M. Henry, personal communication. See also reference No. 4.

ing paper. This mark was also recorded as No. 1. This same process was repeated for the remaining four jumps. After the five recorded jumps had been completed, the experimenter measured each jump by means of a metric rule. All measurements were recorded in millimeters.

After the head-piece was adjusted on each subject, a verbal explanation of the technique was given followed by a single demonstration made by the experimenter. No pause at the bottom of the dip was permitted. The experimenter oriented the subject both frontally and laterally before each jump. The floor was covered with thin rubber matting to avoid slipping.

In order to avoid the effect of any restricting forces such as shoes or socks, the subjects jumped in bare feet. The subjects were allowed to wear either sweat clothing or a pair of slacks and shirt. The jumps were made singly about 30 seconds apart. Just before the fifth jump, the subject was told that it would be his last jump and was motivated verbally to a maximal effort.

The method used was in accordance with the results of a previous investigation of the Sargent test by Henry (4), which led to the conclusion that practice can be standardized best by (a) allowing all subjects a uniform practice series of three trials before the test series; or (b) allowing no practice and averaging the scores of five or more trials. Scores based on the average of several trials appeared to be more representative of individual ability in the Sargent test than "best" scores; they also tended to be more valid.

Standing Broad Jump and Running High Jump.—Both the high jump and broad jump were run off as in a regular track meet with the experimenter serving as the chief official and scorer. Two student assistants had been instructed in the methods of measuring and served as assistants in both the broad jump and high jump. No one subject was allowed to execute more than one of the jumping tests in a single day.

In testing the standing broad jump, the experimenter demonstrated the method to be used and then let each subject take two practice jumps in turn. Then the subjects were formed into a column and allowed to take three jumps in turn. About 15 minutes elapsed between jumps.

The subjects for the running high jump were divided into three groups and the test was run off on three consecutive days. The writer felt it best to test the subjects in smaller groups in order that not too much time would elapse between jumps. Each subject was required to jump scissors style and continued in the competition till he had failed three times at any one height. The bar was raised one inch at a time. The scissors style was used as all subjects were acquainted with this style of jumping whereas only six subjects had practiced the roll style of jumping.

It was impossible to contact some of the subjects the last two weeks of the school year and thus, not all subjects completed all jumping events. Thirty-three subjects were tested in the Sargent jump; 45 subjects, in the running high jump; and 36 subjects, in the standing broad jump. Coefficients of correlation were then calculated for various ratios and single measurements of the foot with each of the three types of jumps to determine those measurements or combination of measurements, if any, that had any relation to jumping performance as well as substantiating or disproving Campbell's and Howell's contradictory theories.

Reliability of Foot Measurements.—In a preliminary study using 21 college students (physical education majors at the University of California), the writer measured each subject twice. The time between the test and retest ranged from one to three weeks. The test-retest correlation coefficients for each of the measures follows:

Heel-to-medial malleolus (right)	.770
Heel-to-medial malleolus (left)	.813
Heel-to-metatarsal-phalangeal measurement (right)	.911
Heel-to-metatarsal-phalangeal measurement (left)	.956
Ratio of average heel-to-ankle measurement (L & R) over total foot length	.914
Height of medial malleolus (right)	.900
Height of medial malleolus (left)	.937
Total foot length (left)	.985

With the exception of the heel-to-medial malleolus, there was a high degree of reliability. In order to check the reliability of this particular measurement, the writer secured two tests on the 47 high school athletes used as subjects in the main study. Following the initial measurement of each subject, the experimenter had the subject remove his foot from the measuring apparatus and then reinsert his foot in the measuring apparatus again. The test-retest correlation in this case was found to be .975. The writer feels that this increase in reliability over the first study may have resulted from more accurate care taken to see that the lower leg was aligned vertically with some object in the room before measuring began. The increased reliability is greater than can be accounted for by the fact that the high school boys have a greater range in size than the college students.

EXPERIMENTAL RESULTS AND DISCUSSION

The results obtained in the experiment seem to substantiate the hypothesis that the speed-lever type of foot is advantageous. This is based on the Howell theory that jumping specialization among animals culminates in a relative lengthening in the distal elements of the hind limbs. For example, using as a measure the proportion of the human foot that is distal to the malleolus, a statistically significant correlation of $r = .41$ with jumping ability as measured by the average stand-

ardized Sargent jump is found. Smaller correlations that seem to point in the same direction are found between the foot measurement and the standing broad jump ($r = .20$) and the running high jump ($r = .15$). When the foot measurement is considered in proportion to the weight of the athlete ($\frac{\text{foot measurement}}{\text{weight}}$), a correlation of $r = .30$ is found with the Sargent jump, and the correlation increases to $r = .53$ with the broad jump and $r = .58$ in the high jump.

These correlations are opposite in sign to what would be expected according to Campbell's theory that the long heel-to-ankle, or "power" type of foot, would be advantageous in jumping ability. The average heel-to-ankle length directly correlates $r = -.33$ with the Sargent jump, $r = -.06$ with the broad jump, and $r = .02$ with the high jump. This heel-to-ankle length, when considered as a proportion of the total foot length, correlates $r = -.41$ with the Sargent jump, $r = -.20$ with the broad jump, and $r = -.15$ with the high jump. When the weight of the jumper is taken into account as described above, correlations of —.30, —.53, and —.58 are found with the Sargent jump, the broad jump, and the high jump respectively.

When only one of the ankle landmarks (medial malleolus) was used to locate the distal length of the foot (ankle-to-end of toe measurement), a correlation of $r = .18$ was found with the Sargent jump. When the average of the two ankle landmarks was used in determining the distal length of the foot, a correlation of $r = .33$ was found between this measure and the Sargent jump. Apparently, the axis of movement is located more accurately by the use of the two points.

The total foot length, when considered by itself, did not correlate significantly with any of the three types of jumps. The height of the foot (medial malleolus) also failed to correlate significantly with jumping ability.

The results of this study are in agreement with the study of Henry (4) who found that the average of a series of jumping scores was a better measure than the best score. (It is a common practice to use "best" under the assumption that it is a better measure of ability.) This is shown in Table I.

TABLE I

CORRELATIONS BETWEEN FOOT MEASURES AND JUMPING ABILITY

	Average Sargent Jump	*Best Sargent Jump*
The proportion of the foot distal to the malleolus	.41	.37
Average ankle to end-of-toe measurement	.33	.29
Medial malleolus to end of toe	.18	.15
Average total foot length	.01	.02
Average height of medial malleolus	.08	.07
Proportion of the foot distal to the malleolus to the metatarsal-phalangeal joint	.42	.39
Proportion of distal foot/weight	.30	.24

With the exception of the average total foot length, a higher correlation was found with the average Sargent jump in all of the above measures.

SUMMARY AND CONCLUSIONS

Foot-lever measurements of 47 high school track athletes were obtained in order to determine if some particular type of foot was of value in jumping as measured by the Sargent jump, the average standing broad jump, and the running high jump. The experiment was designed to test Campbell's hypothesis that a relatively long heel-to-ankle construction of the foot is advantageous, and a different hypothesis, developed from Howell's theory based on a comparison of the structural adaptation of jumping animals, that a relatively long ankle-to-toe measurement is best suited for jumping.

On the basis of the findings, it may be concluded that the Howell, rather than the Campbell, concept is substantiated. Specifically:

1. The longer the malleolus-distal measurement in proportion to the total foot length, the greater the jumping ability. This ratio was found to correlate significantly ($r = .41$) with the average of five Sargent jumps.

2. The longer the malleolus-to-metatarsal-phalangeal measurement in proportion to the heel-to-metatarsal-phalangeal measurement, the greater the jumping ability. This ratio was found to correlate $r = .42$ with the Sargent jump.

3. The less the heel-to-ankle measurement (absolute rather than relative), the less the advantage in jumping. The correlation with the Sargent jump was $r = .33$ (of borderline statistical significance).

4. There is no significant degree of relationship between total foot length and jumping ability.

5. The ratio of the average heel-to-ankle measurement of the two feet to total foot length correlated $r = -.20$ with the standing broad jump and $r = -.15$ with the running high jump. These correlations are not statistically significant.

6. When the factor of body weight is included in the calculations, the coefficients of correlation increased. The proportion of the distal foot/weight correlates $r = .30$ with the Sargent jump and increases to $r = .53$ with the broad jump and $r = .58$ in the high jump. The latter two correlations are statistically significant above the one percent level of confidence.

7. None of these correlations is sufficiently high to be of much practical use for predictive purposes, which agrees with Krakower's conclusions concerning relative leg length of track men.

8. Average scores are a better measure than best scores as was found when certain foot measures were correlated with the Sargent jump.

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National Survey of Physical Education And Sports Insurance Plans

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PRESENTED herewith is a summary of statistics on physical education and sports insurance plans currently in operation within, or in conjunction with, the state high school athletic associations. The data were collected directly from the commissioners and executive secretaries of the various state high school athletic associations. The writer received replies from forty-two high school athletic associations and reliable information concerning the remaining six states from O. L. Webb, secretary of the Nebraska High School Athletic Association.

It is interesting to note that forty-three state high school athletic associations are operating benefit plans for the 1949-50 school year, either within their own association or underwritten by a commercial insurance company.

The thirty states operating benefit plans within their own high school athletic associations are California, Colorado, Connecticut, Florida, Georgia, Idaho, Iowa, Kentucky, Kansas, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, West Virginia, and Wisconsin.

The thirteen states operating benefit plans underwritten by commercial companies are Alabama, Arkansas, Delaware, Illinois, Indiana, Maryland, Missouri, New Jersey, New Mexico, Tennessee, Texas, Washington, and Wyoming.

Of the remaining five states, South Carolina and Virginia are studying plans and hope to have them in operation in the near future, while Arizona, Louisiana, and North Carolina have no definite plans contemplated.

The following twenty-two states offer accident insurance for *athletic teams, intramurals, and physical education:* California, Connecticut, Florida, Indiana, Kansas, Kentucky, Massachusetts, Michigan, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Dakota, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, and Wisconsin.

Arkansas, Idaho, New Mexico, Washington, and Wyoming offer benefits for *athletic teams, physical education,* and any other *hazardous play activity.*

Of the remaining states having benefit plans, Alabama, Colorado, Delaware, Georgia, Illinois, Iowa, Maryland, Minnesota, Montana, Nebraska, Nevada, Ohio, South Dakota, Texas, and West Virginia offer accident insurance for *athletic teams only*.

Wisconsin and Oklahoma probably have the most outstanding benefit plans. Wisconsin offers accident benefits for athletic teams, intramurals, physical education, and summer sports programs, while Oklahoma offers benefits for athletic teams, intramurals, physical education, and camping.

In addition to the above data, it may be interesting to know that some states offer athletic team insurance to girls also. States having the most beneficial plans for girls' sports programs are Connecticut, Florida, Georgia, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Nebraska, New Hampshire, New York, North Dakota, Oklahoma, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, and Wisconsin.

The premiums per individual (subsidized partially by the school) showed the following range: all sports, $1.00 to $5.00; football only, $1.00 to $5.00; basketball only, $.25 to $5.00; sports other than football and basketball, $.25 to $5.00, with a number of states making a specific charge for each listed sport.

The following states have a membership fee included in their benefit plans: Arkansas, Connecticut, Georgia, Idaho, Iowa, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Mexico, North Dakota, Pennsylvania, Rhode Island, South Dakota, Texas, Utah, Vermont, Wisconsin, and Wyoming.

The membership fees vary as follows: (1) according to school enrollment; (2) flat rate for all schools regardless of school population; (3) according to size of athletic squads; and (4) additional levy for championship tournaments and meets.

The number of scheduled injury indemnities ranges from thirty-two to one hundred and fourteen, Oklahoma having the least number of indemnities scheduled and Washington having the most. The money benefits range from one dollar to one thousand dollars, with an average death benefit of three hundred dollars. The highest death benefits ($1,000.00) are offered by the commercial insurance companies such as the Security Life and Accident Company (a stock company) of Denver, Colorado, which issues an Accident Benefit Plan for members of the Washington High School Athletic Association.

In general, most physical education and sports insurance plans offer coverage for injuries incurred in the play or practice of a *supervised* sport, including injuries in the dressing room or showers, and in transportation to and from practice and games. School officials

have been unanimous in their praise for such complete coverage as that mentioned above. The Wisconsin Interscholastic Athletic Association Accident Benefit Plan can be credited with having the most complete coverage for injuries within a state high school association.[1]

The functions of an athletic accident benefit plan most frequently mentioned in the various state bulletins and insurance plans could be summarized as follows:

1. To assist parents in meeting medical and hospital bills.
2. To provide immediate diagnostic and medical attention when needed.
3. To make schools and pupils safety conscious and to encourage safety measures and an adequate health program.
4. To relieve schools of financial responsibility.
5. To ensure a thorough medical examination for each pupil covered.

Others mentioned by two or more states are as follows:

1. To reduce costs through cooperation with doctors and dentists.
2. To provide low-cost protection.
3. To provide prompt reporting and record of injuries.
4. To serve as a good public relations device.

Changes contemplated for next year are:

1. To simplify forms.
2. To increase benefits.
3. To raise registration fee.
4. To cover junior college athletics.
5. To use a full-time secretary.
6. To include school administrators, coaches, and officials.
7. To include all extracurricular activities.
8. To add, possibly, all pupil coverage.
9. To require all schools to take coverage.

In bringing this statistical summary to a close, it may be said that Wisconsin has the best all-round athletic benefit system within the state associations, while Washington has the most beneficial plan underwritten by a commercial company.

Wisconsin Interscholastic Athletic Association
Athletic Accident Benefit Plan

SCHEDULE OF BENEFITS

The WIAA Schedule of Benefits is the maximum which the Association can afford to pay. The schedule does not intend to determine or limit the charges of the physician. Schools have a choice of schedules, depending upon the premium they wish to pay.

[1] Schedule of indemnities for WIAA Athletic Accident Benefit Plan will be found at end of article.

	"A"	"B"
Principal sum not to exceed	$300	$300
1. Entire sight of one eye if irrevocably lost	200	200
2. Fractured pelvis	100	100
3. Fractured body of vertebrae	60	100
4. Fractured process of vertebrae	25	50
5. Fractured skull with cerebral hemorrhage	80	100
6. Cerebral hemorrhage	60	75
7. Fractured skull	50	50
8. Concussion of the brain	15	25
9. Both bones of either leg fractured between ankle and knee	100	100
10. Both bones of either arm fractured between wrist and elbow	85	85
11. Either leg fractured above the knee and in a cast	75	75
12. Either arm fractured above the elbow	50	60
13. Either bone of either leg fractured between ankle and knee	40	50
14. Either bone of either arm fractured between wrist and elbow	30	40
15. Fractured knee cap	50	75
16. Injured knee requiring surgery	60	75
17. Ruptured kidney, positive blood in kidney	50	50
18. Ruptured spleen		50
19. Ruptured liver		50
20. Fractured sternum	25	35
21. Fractured collar bone	30	35
22. Fractured scapula	30	35
23. Fractured cheek bone	30	35
24. Operation for ligating of artery	25	25
25. Fractured nose	15	25
26. Fractured carpal or tarsal bone		25
27. Fractured ribs, two or more (one rib only, $7.50)	15	15
28. Fractured bone in hand requiring banjo splint		25
29. Fractured bone in hand, radiograph required	12.50	15
30. Fractured bone in hand, no radiograph	10	10
31. Fractured bone in foot, radiograph required	12.50	15
32. Fractured bone in foot, no radiograph	10	10
33. Dislocated hip	35	50
34. Dislocated vertebrae	35	50
35. Dislocated knee	25	25
36. Dislocated knee, requiring cast		35
37. Dislocated shoulder	17.50	25
38. Acromio-clavicular dislocation	17.50	25
39. Dislocated ankle	15	20
40. Dislocated ankle, requiring cast		30
41. Dislocated elbow	15	25
42. Dislocated wrist	10	15
43. Aspiration of knee or elbow	10	15
44. X-ray examination to determine fracture of extremities (negative to fracture or dislocation)	5	7.50
45. X-ray to determine fracture of head (negative to fracture or dislocation)	10.50	10
46. Fluoroscope examination to determine fracture (negative to fracture or dislocation)	2	5
47. Separation of tendon from bone	5	10
48. Suture of laceration	3	5
49. Suture of laceration requiring tetanus	6	8

	"A"	"B"
50. Hospital benefit	75	100
51. Medical attendance, maximum	12	18
52. If an injury does not come under the above schedule of benefits but requires treatment by a legally qualified physician or surgeon, not including treatment on the field at the time of play or practice, an allowance of	2	3
for the first treatment and	1	1.50
for each subsequent treatment		

DENTAL SCHEDULE

1. Fracture of enamel requiring treatment and polishing only	$2	$3
2. Replacing broken facing	4	5
3. Re-cementing loosened crown or inlay	2	2
4. Fractured tooth	2 to $30	3 to $40
5. Loss of one or more anterior or posterior teeth requiring bridgework, per tooth	12	15
Maximum allowance	50	90
6. Injury requiring an upper or lower partial denture, $15 per tooth, maximum	50	80
7. Injury to tooth, not fractured, but requiring pulp removal and filling	10	15
8. a. Repairing broken teeth on denture or partial dentures, first tooth	8	10
b. Repairing dentures or partial dentures broken, but no teeth involved	2	2
c. Adding teeth on denture to replace extracted natural teeth, first tooth	10	15
Each additional tooth	2	2
9. Fractures		
a. Simple, including post-operative care and x-rays	30	75
b. Compound, including post-operative care and x-rays	50	100
10. Extraction only	2	3

The Specificity of Flexibility in Girls

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INTRODUCTION

THIS study constitutes an experimental approach to the concept of flexibility. In the field of physical education there are many expressions of opinion regarding flexibility of the body with a paucity of supporting evidence. The research literature is of little help in clearing the existing ambiguities regarding the characteristics of flexibility. Flexibility is commonly spoken of as a general ability rather than a number of specific abilities, and the notion is still popular that young children are very flexible and that they become progressively less flexible as they become older.

In May, 1941, Cureton [1] summarized the literature up to that date. More recent studies include one by Leighton [2] in which he validated an instrument for the measurement of flexibility and one by Small [3] which revealed that exercise increased the ankle flexibility of women. Campbell [4] determined some of the factors that influence flexibility by evaluating the effect of rhythmic stretching exercises on the flexion range of the hip joint, and Scully [5] devised eleven inspectional tests for the appraisal of the flexibility status of girls. Guerewitsch and O'Neill [6] investigated the degree of flexibility considered normal for different age groups, and Poley [7] studied certain variables of posture in relation to body build, strength, and flexibility.

The specific purposes of this study are (1) to determine whether flexibility in girls is a general factor or one that is specific to certain

[1] Thomas K. Cureton, "Flexibility as an Aspect of Physical Fitness," *Supplement to Research Quarterly*, 12:2 (May, 1941), pp. 381-390.

[2] Jack R. Leighton, "A Simple Objective and Reliable Measure of Flexibility," *Research Quarterly*, 13:2 (May, 1942), pp. 205-216.

[3] Margaret Small. Range of joint movement and studies in flexibility of the ankle joint. Unpublished master's thesis, University of Wisconsin, 1942.

[4] Rose E. Campbell. A study of factors affecting flexibility. Unpublished master's thesis, University of Wisconsin, 1944.

[5] Grace M. Scully. Tests and administrative procedures for appraising flexibility of secondary school girls with suggested exercises for increasing flexibility. Unpublished master's thesis, University of Oregon, 1946.

[6] A. D. Guerewitsch and Margaret O'Neill, "Flexibility of Healthy Children," *Archives of Physical Therapy*, 25 (April, 1944), pp. 216-221.

[7] Margaret S. Poley, "An Investigation Concerning Certain Variables of Posture in Relation to Body Build, Strength, and Flexibility," *The Delta Kappa Gamma Bulletin*, 15:2 (Winter, 1939), pp. 17-34.

joints of the body, and (2) to ascertain whether girls become progressively less flexible as they advance in age from six to eighteen years.

PROCEDURE

The subjects for this study were three hundred girls who were attending the public schools in Eugene, Oregon, and the University of Oregon. They ranged in age from six to eighteen years.

The following twelve measurements of flexibility were taken twice in succession on each girl: elbow flexion and extension, wrist flexion and extension, shoulder flexion and extension, ankle flexion and extension, leg abduction, knee flexion, thigh flexion, hip flexion and extension, trunk and hip flexion and extension, side trunk flexion and extension, head rotation, and head flexion and extension. The instrument used for the measurements was a goniometer, called the "Leighton Flexometer." All the measurements were taken according to the directions given by Leighton [8] using joints on the right side of the body only.

ANALYSIS OF THE DATA

The first step in the analysis was that of determining the reliability for each measurement as a basis for later study of the degree of specificity or generality. The reliabilities were obtained from two measurements taken in immediate succession on sixty subjects eighteen years of age.* The method used was that of determining Pearson product-moment correlation coefficients. These are shown in Table I.

TABLE I

RELIABILITIES OF VARIABLES

Variable	*Number of Cases*	*Reliability Coefficients*	*Standard Error*
Elbow flexion	60	.936	.016
Wrist flexion-extension	60	.935	.016
Shoulder flexion-extension	60	.956	.011
Ankle flexion-extension	60	.965	.009
Leg abduction	60	.911	.022
Knee flexion	60	.919	.020
Thigh flexion	60	.955	.011
Hip flexion-extension	60	.958	.011
Trunk-hip flexion-extension	60	.972	.007
Side trunk flexion-extension	60	.941	.015
Head rotation	60	.916	.021
Head flexion-extension	60	.971	.007

[8] Leighton, *op. cit.*, pp. 209-215.

* This age group was more readily available for repeated measurement than the subjects at earlier ages.

In order that the measuring procedure might be standardized, every subject was tested and measured without being permitted to do any exercise which might serve as a warm-up of any portion of the body.

Having reliabilities above $r = .9$ for every measurement taken, it was next possible to move on to the study of the central problem of the degree of general flexibility. This was done, again using the Pearson product-moment method, by calculating the correlation for each possible pairing of the variables studied. These intercorrelations are shown in Table II. It will be seen that only nine of the sixty-six coefficients are higher than $r = .3$, while thirty-one are so low as not to be statistically significant (i.e., their magnitudes are less than three times the standard error).**

TABLE II

COEFFICIENTS OF INTERCORRELATIONS OF MEASUREMENTS OF FLEXIBILITY

	2	3	4	5	6	7	8	9	10	11	12
1.	.632*	.368	.064	.264	-.026	.092	-.039	.158	.092	.199	.181
2.		.540	.058	.269	.062	.072	.050	.258	.074	.331	.201
3.			.335	.263	.160	.283	.049	.293	.096	.255	.225
4.				.051	.201	.083	.120	.031	.161	.054	.092
5.					.174	.082	.066	.173	.254	.408	.146
6.						.351	.183	.134	.276	.007	.164
7.							.202	.190	.169	.173	.249
8.								.192	.350	-.101	.229
9.									.239	.143	.298
10.										.116	.471
11.											.151

Key to Numerical Loadings:

1. Hip flexion-extension
2. Trunk-hip flexion-extension
3. Side trunk flexion-extension
4. Head rotation
5. Head flexion-extension
6. Elbow flexion-extension
7. Wrist flexion-extension
8. Shoulder flexion-extension
9. Ankle flexion-extension
10. Knee flexion-extension
11. Leg abduction
12. Thigh flexion-extension

* Intercorrelation coefficients that are underscored are those remaining after the test of significance had been applied.

Common reasons for low intercorrelations are (1) low reliabilities, (2) lack of variability in the subjects, or (3) lack of a common factor in the variables. The first reason is ruled out because the reliabilities as revealed in Table II were found to be high. The second reason is also ruled out by the fact that a wider "range of talent" was used, since children of ages from six to eighteen and of

** In order to check for curvilinearity, the correlation ratio (Eta) was obtained in four instances. For variables 1 with 2, r was .63 and η .68; for variables 2 with 3, r was .54 and η .57; for variables 5 with 6, r was .17 and η .18; and for variables 5 with 9, r was .17 and η .18. It will be seen that the degree of curvilinearity is very slight.

all grades from elementary to college were represented. By the process of elimination, the only remaining reason for a low correlation is the absence of a strong common factor. The specific factors are apparently the important ones manifested through the variables.

Since the variables are all measures of flexibility, they must, therefore, be heavily loaded with group factors or factors unique to each joint. From the analysis of the data in this study, therefore, there is no evidence of the appreciable role of a factor that can be designated "general flexibility."

This finding is in agreement with a conclusion reached by Cureton, who also found low coefficients of intercorrelation between four measurements of flexibility and who concluded: "The tests are, therefore, fairly specific, which means that flexibility is not some general quality which causes all tests of it to vary alike. Each major joint has a high degree of specific condition of its own." [9] Cureton's study appears to be the only one in the literature in which the specificity of flexibility is proclaimed and supported with factual evidence.

TABLE III

INDIVIDUAL RECORDS IN FIVE AGE GROUPS

	6 years (50 cases)	9 years (50 cases)	12 years (50 cases)	15 years (50 cases)	18 years (100 cases)
Individuals who reach or exceed mean in all measurements	0	2	3	1	0
Individuals who reach or exceed mean in all but one measurement	1	1	1	1	6
Individuals who reach or exceed mean in all but two measurements	8	7	2	4	7
Individuals who are below mean in all measurements	0	2	0	2	2
Individuals who are below mean in all but one measurement	1	2	3	1	0
Individuals who are below mean in all but two measurements	2	0	4	1	5

Another procedure for displaying the low degree of relationship found is that of considering the extent to which individuals were consistently high or consistently low in the various measurements taken. It was found that only six (2 percent) girls reached or exceeded the averages for their respective age groups in all twelve

[9] Cureton, *op. cit.*, p. 329.

measurements of flexibility (Table III). These cases were in the nine-, twelve-, and fifteen-year-old groups. Six percent were below the averages of their respective age groups in all twelve measurements of flexibility in two or more joints. These findings lend addi-

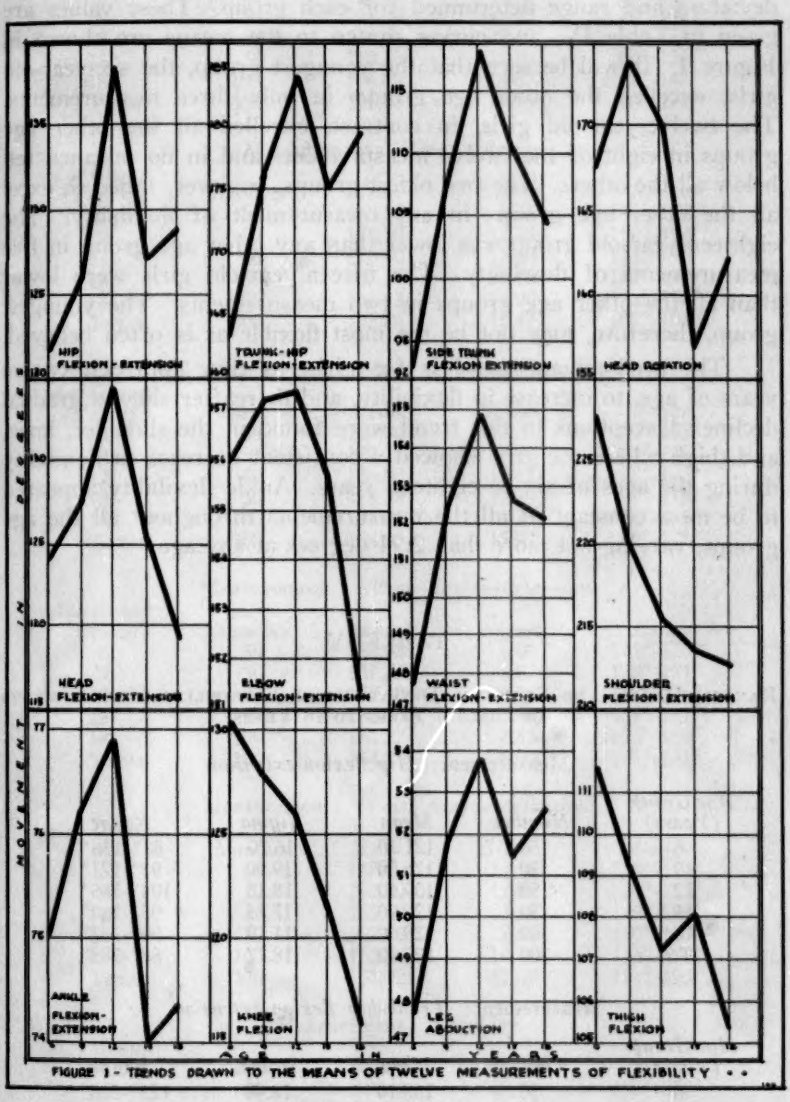

FIGURE 1 - TRENDS DRAWN TO THE MEANS OF TWELVE MEASUREMENTS OF FLEXIBILITY

tional support to the earlier evidence that flexibility is not entirely, or even largely, a general factor.

The third step in analysis was that of investigating the direction

of age changes in flexibility. Specifically the problem here was to obtain information on the question of whether children tend to decrease in flexibility as they become older. The data for each measurement were distributed in five age groups, and the mean, standard deviation and range determined for each group. These values are given in Table IV, and curves drawn to the means are shown in Figure 1. It will be seen that the youngest group, the six-year-old girls, excelled the other age groups in only three measurements. The twelve-year-old girls, in contrast, excelled all the other age groups in eight of the twelve measurements and in no instance fell below all the others. The two oldest groups, however, failed to excel all the other age groups in any measurement of flexibility. The eighteen-year-old group was lower than any other age group in five measurements of flexibility. The fifteen-year-old girls were lower than all the other age groups in two measurements. The youngest group, therefore, may not be the most flexible as is often believed.

The predominant trend is for girls, as they approach twelve years of age, to increase in flexibility, and thereafter show a gradual decline. Exceptions to this trend were found in the shoulder, knee, and thigh where the girls showed a consistent decrease in flexibility during the ages of six to eighteen years. Ankle flexibility appeared to be most constant of all the measurements throughout all the age groups, varying not more than 2.94 degrees at any age.

TABLE IV

RANGES, MEANS AND STANDARD DEVIATIONS OF FLEXIBILITY MEASUREMENTS OF GIRLS 6 YEARS TO 18 YEARS

Measurement: *Hip flexion-extension*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	121.30	16.70	88°-156°
9	50	126.50	19.90	92°-171°
12	50	139.10	18.15	104°-185°
15	50	126.90	17.75	95°-160°
18	100	128.60	11.10	90°-162°
TOTAL	300	127.90	18.72	88°-185°

Measurement: *Trunk-hip flexion-extension*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	163.10	18.40	125°-208°
9	50	176.60	17.15	138°-220°
12	50	185.20	18.25	155°-233°
15	50	175.10	15.95	140°-212°
18	100	179.40	19.30	136°-234°
TOTAL	300	175.98	19.35	125°-234°

TABLE IV (Cont.)

Measurement: *Side trunk flexion-extension*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	92.00	13.95	58°-130°
9	50	107.20	18.05	70°-142°
12	50	118.34	20.40	75°-171°
15	50	110.40	18.80	80°-156°
18	100	104.40	18.00	77°-147°
TOTAL	300	105.65	19.35	58°-171°

Measurement: *Head Rotation*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	168.50	9.51	146°-188°
9	50	174.10	12.15	152°-194°
12	50	170.40	13.60	115°-193°
15	50	157.30	20.16	107°-192°
18	100	163.15	14.00	122°-186°
TOTAL	300	165.86	15.47	107°-194°

Measurement: *Head flexion-extension*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	124.30	13.65	80°-155°
9	50	127.70	12.45	88°-146°
12	50	134.90	18.15	98°-175°
15	50	125.38	17.29	93°-178°
18	100	119.35	13.75	88°-175°
TOTAL	300	124.95	15.92	80°-178°

Measurement: *Elbow flexion-extension*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	155.98	6.00	145°-170°
9	50	157.26	6.87	138°-171°
12	50	157.42	8.13	137°-176°
15	50	155.66	7.50	137°-181°
18	100	151.27	7.83	125°-169°
TOTAL	300	154.85	8.00	125°-181°

Measurement: *Wrist flexion-extension*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	147.40	11.15	118°-174°
9	50	152.30	12.85	120°-185°
12	50	155.10	13.15	128°-193°
15	50	152.60	17.65	120°-190°
18	100	152.10	10.71	111°-180°
TOTAL	300	151.92	12.60	111°-193°

Measurement: *Shoulder*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	228.40	12.90	193°-250°
9	50	219.70	11.04	193°-246°
12	50	215.46	12.04	190°-239°
15	50	213.02	11.91	187°-245°
18	100	212.75	12.00	175°-233°
TOTAL	300	216.24	12.90	175°-250°

TABLE IV (Cont.)

Measurement: *Ankle*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	75.06	9.18	51°- 95°
9	50	76.34	9.00	55°- 95°
12	50	76.94	9.24	61°- 95°
15	50	74.00	11.30	36°-100°
18	100	74.38	8.52	53°- 96°
TOTAL	300	74.50	9.20	36°-100°

Measurement: *Knee flexion*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	130.62	9.64	107°-147°
9	50	127.68	9.90	104°-150°
12	50	125.88	8.46	104°-143°
15	50	121.48	6.63	100°-135°
18	100	115.95	8.85	100°-134°
TOTAL	300	123.90	10.28	100°-150°

Measurement: *Leg abduction*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	47.38	7.98	36°- 70°
9	50	51.78	10.20	37°- 76°
12	50	53.94	8.94	38°- 78°
15	50	51.40	8.79	33°- 72°
18	100	52.60	7.65	35°- 70°
TOTAL	300	51.46	8.88	33°- 78°

Measurement: *Thigh flexion*

Age Group (Years)	*Number*	*Mean*	*Sigma*	*Range*
6	50	111.78	9.24	95°-130°
9	50	109.26	10.56	83°-130°
12	50	107.18	9.39	85°-126°
15	50	108.10	12.20	80°-137°
18	100	105.40	10.95	76°-128°
TOTAL	300	107.40	10.75	76°-135°

SUMMARY OF FINDINGS

The data used in this study were collected from three hundred girls ranging in age from six to eighteen years. The subjects were in attendance at the public schools and the University of Oregon in Eugene, Oregon. A total of twelve measurements of flexibility was obtained on each girl. Analysis of the data yields the following findings:

1. No girl was significantly above the average in all twelve measurements of flexibility.

2. No girl was significantly below the average in all twelve measurements of flexibility.

3. In nine of the twelve measurements, girls increased in flexibility from age six to age twelve years and then showed a decline.

4. Girls decreased gradually in shoulder, knee, and hip (thigh flexion) flexibilities from the ages of six to eighteen years.

5. Eighteen-year-old girls were more flexible in certain respects (i.e., side trunk flexion-extension, hip flexion-extension, wrist flexion-extension, leg abduction and trunk-hip flexion-extension) than girls six years of age.

The group used in this study was selected on a school class basis rather than in a strictly random manner, so it may or may not be representative of the total population. The evidence indicates clearly that, in the group studied, flexibility in girls is a function of specific factors and not a general factor, and that the areas of the girls' bodies, for the most part, become progressively more flexible from childhood to adolescence and then they become progressively less flexible after adolescence.

An Analysis of the Health Interest of 3,000 Secondary School Students

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(Submitted for publication January, 1949)

FOR many years the discovery of pupil interests has been considered of primary importance in developing the school curriculum. In recent years health education has become a part of the school curriculum, but relatively little attention has been given to the matter of health interests in respect to curriculum building. Interests in health have been considered in several studies, but no sound inventories have been prepared for use in establishing learning experiences in the high school curriculum. This study concerns itself with the determination of the health interests of 3,000 secondary school students as a partial basis for curriculum construction.

The health interest inventory compiled by Byrd and described in another article in this issue was used in eight secondary schools in California as a means of determining health interests of students at this academic level. These schools are indicated in the following table:

CALIFORNIA SECONDARY SCHOOLS USED IN STUDY OF HEALTH INTERESTS

Name of School	*Location*	*Size*	*County*	*Cases*
Alhambra Union High School	Martinez	471	Contra Costa	259
Bret Harte Union High School	Angels Camp	157	Calaveras	119
Jordan Junior High School	Palo Alto	792	Santa Clara	240
Mission High School	San Francisco	2137	San Francisco	1423
Mountain View Union High School	Mountain View	604	Santa Clara	283
Palo Alto High School	Palo Alto	803	Santa Clara	59
Summerville Union High School	Tuolomne	66	Tuolomne	46
Washington Union High School	Centerville	698	Alameda	566

Brete Harte and Summerville Union High Schools are small rural schools in farming and lumbering areas. Mountain View and Centerville Union High Schools represent medium-sized secondary schools with a population from farming, industrial, fruit, and vegetable-producing areas. Jordan Junior High School and Palo Alto Senior High Schools are located near Stanford University. A high percentage of their students are from professional and upper middle-class families in this residential community. The student body of Mission High School, San Francisco, represents a cross section of the population of the metropolis.

The inventories were administered in such a manner as to encourage the students to check items of interest without inhibition. The inventories were taken anonymously. Three thousand cases were used.

Information on the inventories was transferred to International Business Machine scoring cards and analyzed as follows:

1. Analysis of total response on all items giving rank order of items from high to low interest.

2. Computation of student interests according to major health areas.

3. Computation of interests on the entire inventory, each major health area, and in each item by religion, grade in school, and sex.

VALIDITY AND RELIABILITY

Validity of this inventory was established in the following two ways:

1. The significance of the health problems listed was established by selection from 10,000 health articles in leading medical and public health journals. Frequent discussions of health problems in the professional medical and public health journals would appear to establish these problems as significant ones.

2. The inventory was administered to a group of high school students on a trial basis which eliminated overly technical terms and other confusing factors.

Reliability of this inventory was established as follows:

1. Correlations of .70 and .74 between this study and a study conducted by Jessop in San Jose, California, with a similar, preliminary but not identical form of the health inventory with 640 secondary school students.

2. Correlations of .87 between test and retest with one school group; .91 between test and retest with another school group; and .92 with a third retest group on the high school level.

3. Computation of .91 reliability by the split-half method on 200 inventories.

On the basis of the foregoing it was concluded by the author that the health interest inventory was both valid and reliable.

Listed in rank order in Table I are the 50 leading health interests of the 3,000 high school students of this study.*

* The author's doctoral dissertation at Stanford University, "An Analysis of the Health Interests of 3,000 Secondary School Students," should be consulted for rank order listing of all 300 items of the inventory.

TABLE I

50 LEADING HEALTH INTERESTS OF 3,000 SECONDARY SCHOOL STUDENTS

Health Problem	*Percentage of Students Interested*
1. Juvenile delinquency	66
2. Sex instruction	65
3. Causes of suicide	56
4. Cancer	54
5. Tobacco and human health	53
6. Preparation for marriage	52
7. Lifelong care of the eyes	50
8. Safest age to have a baby	50
9. Hit-and-run drivers	50
10. How to report accidents	50
11. Sunburn	50
12. How to have good posture	50
13. Causes of mental illness	50
14. Problems of tooth decay	50
15. Problems of alcohol	48
16. Schools and juvenile delinquency	47
17. Dangers of sleeping pills	47
18. Speed and accidents	46
19. Atomic warfare	46
20. Conquest of disease	46
21. War and disease	45
22. Sweets and dental decay	45
23. Drunken driving	45
24. Effects of tea and coffee	44
25. How to use a gun properly	44
26. Pregnancy and health	43
27. Poison oak	43
28. Child labor	42
29. Mental health and marriage	42
30. Dangers of high I. Q.	42
31. Is cancer inherited?	42
32. Sports vs. apparatus activity	41
33. Common sicknesses	41
34. Earthquakes	41
35. Births in hospitals or homes	40
36. The ability to have children	39
37. Tuberculosis and pregnancy	39
38. Breast or bottle feeding	39
39. Protecting pedestrians	38
40. Causes of infant death	38
41. Candy and dental health	37
42. Can drug addicts be cured?	37
43. Deaths of mothers in childbirth	37
44. Parking and traffic accidents	37
45. Relaxation (resting)	37
46. Communicable diseases	37
47. Psychological basis of crime	37
48. Tuberculosis	37
49. Social diseases of the school	37
50. Food during pregnancy	36

Interests in the 21 major health areas of the inventory varied considerably in this group of 3,000 high school students. In view of the fact that most states require by law that the school instruct the pupil in the effects of alcohol, tobacco, and narcotics, it is comforting to discover that the interest in habit-forming substances outranked all other major health areas, although some specific health problems in other areas received higher rankings. Listed in Table II are the leading health interests by major areas.

TABLE II

INTERESTS OF 3,000 SECONDARY SCHOOL STUDENTS IN MAJOR HEALTH AREAS

Major Area	*Percentage of Students Interested*
1. Habit-forming substances	38.0
2. Family Health	36.4
3. Safety	36.2
4. Mental Health and Disease	31.0
5. Exercise and Body Mechanics	30.0
6. The Care of Special Organs	29.0
7. Health as a Social Problem	28.4
8. Health and the Physical Environment	27.6
9. Health as a Social Accomplishment	26.0
10. Chronic and Degenerative Disorders	25.0
11. Infection and Immunity	24.2
12. Fatigue and Rest	24.2
13. Nutrition and Health	24.1
14. School Health	23.0
15. Community Health Services	21.0
16. Heredity and Eugenics	20.0
17. Excretion and Health	19.0
18. Health Services and Facilities	18.8
19. Occupational Health	17.0
20. Trends and Possibilities	15.0
21. International Health	14.0

Some differences in health interests by sex and grade level were apparent in this study. Some indications of this may be obtained from a study of the following columns. Following are the percentages of interest in the 10 items of highest interest to the freshman and sophomore boys:

	%
Juvenile delinquency	60
Atomic warfare	57
Sex instruction	57
Tobacco and human health	53
Hit-and-run drivers	52
How to report accidents	51
How to use a gun properly	51
Sports vs. apparatus activity	51
Causes of suicide	51
Cancer	49

Following are the percentages of interest in the 10 items of highest interest to the junior and senior boys:

	%
Sex instruction	63
Sweets and dental decay	60
Juvenile delinquency	60
Tobacco and human health	59
Atomic warfare	57
Causes of suicide	55
How to report accidents	52
Speed and accidents	52
Cancer	52
Hit-and-run drivers	51

Following are the percentages of interest in the 10 items of highest interest to the freshman and sophomore girls:

	%
Juvenile delinquency	69
Sex instruction	63
Safest age to have a baby	60
How to have good posture	57
Causes of suicides	57
Preparation for marriage	57
Cancer	56
Lifelong care of the eyes	55
Causes of mental illness	53
Dangers of sleeping pills	52

Following are the percentages of interest in the 10 items of highest interest to the junior and senior girls:

	%
Sex instruction	77
Preparation for marriage	73
Juvenile delinquency	73
Causes of mental illness	66
Causes of suicides	66
Safest age to have a baby	65
Cancer	62
Pregnancy and health	62
Lifelong care of the eyes	59
Mental health and marriage	58

As a result of this study the following conclusions and recommendations appear to be in order.

CONCLUSIONS

1. Health interests of high school pupils can be measured with a high degree of reliability.
2. There is a very high level of pupil interest in health problems.
3. There is a common core of health interests among high school pupils regardless of age or sex which should prove useful for curriculum construction.

4. These are negligible differences in health interests in respect to religion.

5. There are some variations in health interests between boys and girls; this information should prove useful for segregated classes in health.

6. There are some variations in health interests by grade placement, but these are relatively few in number.

7. Some health problems long considered by teachers to have little interest-appeal to pupils have been shown to rank highly in student interest. Cancer is a good example of this.

8. Some health problems entirely overlooked by some health educators have been revealed as ranking highly in student interest.

9. There are distinct variations in pupil health interests both in major areas and specific detail.

10. It should be possible to improve the quality of learning experiences in health in the school curriculum by utilization of the health interests discovered in such studies as this one.

RECOMMENDATIONS

1. All curriculum directors and teachers of health on the secondary school level should explore pupil health interests as a basis for partial determination of curriculum content.

2. Health instruction on the secondary school level should be partially graded from year to year on a basis of changing health interests.

3. Health classes should not be segregated by sex, inasmuch as there is a fairly common community of health interests among both boys and girls.

4. On the basis of pupil interest greater emphasis should be given in the secondary school curriculum to the category of habit-forming substances which leads all others in interest quality.

5. On the basis of pupil health interests greater emphasis should also be given to family health, safety, and mental health and disease in the secondary school curriculum.

6. The wide variety of health interests shown by high school pupils calls for highly qualified health educators with a breadth of preparation now seldom seen in actual practice.

7. More extensive studies of pupil health interests on a national scale should be made.

A Test for the Full Swinging Shot in Golf

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(Submitted for publication, June, 1949)

THE objectives of this study are, first, to construct a test of the full-swinging shot in golf that is diagnostic, as well as reliable, valid, and objective; second, to determine the validity of using cotton balls in testing the full-swinging shot in golf.

The elements which determine the result of a full-swinging shot in golf are the velocity of the ball, the angle of impact of the club head with the ball, and the angle of deviation to the right or left of the intended line of flight.

HARD BALLS

Equipment and Lay-out of the Test:

1. An area 175 x 80 yards.
2. One rope 175 yards long, marked at each 25 yards with a colored ribbon and each 5 yards between with white ribbons. This rope is laid along the designated line of flight in a straight line with the zero end of the rope at the point from which the balls are to be hit.
3. One steel tape measure 100 feet long.
4. One stop watch.
5. Four sets of colored stakes numbered from one to twenty. Having four sets of different colors allows four subjects to be tested without taking time for measurement.
6. Four dozen golf balls.
7. Score sheets.
8. One number five iron. Subjects were allowed to use their own five iron if they chose to do so.
9. Three administrators, two to place the stakes, one timer and recorder.

The Test.—The test consisted of twenty trials, each trial consisting of one full-swinging shot. A shot in which the ball rolled along the ground or was in the air less than .6 second was not counted as a trial.[1] As each trial was taken, a colored stake with a number corresponding to the number of the trial was placed in the ground at the point where the ball first touched it. A stop watch was

The final study of this test was supported in part by the Research Committee of the State College of Washington.

[1] The velocity computed for a ball that is in the air less than .6 second so nearly approximates the muzzle velocity that it is not feasible to compare it with the average velocities of the other trials.

used to record the time the ball was in the air from the moment of impact until the ball first touched the ground. At the conclusion of the test, the following measurements were taken from the stakes: the distance the ball traveled along the intended line of flight, measured by the rope, and the distance the ball deviated from this intended line of flight, measured by the steel tape measure placed at a right angle to the rope.

Treatment of the Data.—Using the recorded straightaway distance, the distance measured by the rope along the intended line of flight, and the recorded deviation from this straightaway distance allows the construction of a right triangle as shown in Diagram No. 1. By using trigonometric functions, it is possible to determine the angle of deviation from the intended line of flight and the distance the ball actually traveled, which distance is hereafter referred to as the range.

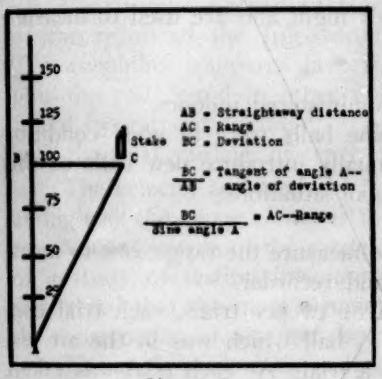

Diagram 1.

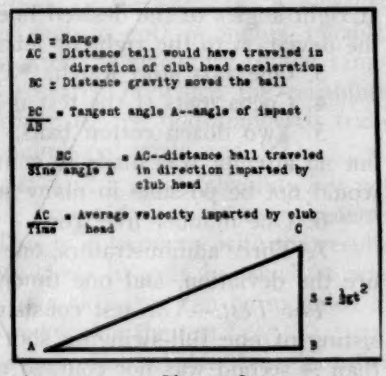

Diagram 2.

In order to calculate the angle of impact, another right triangle is constructed (see Diagram No. 2) using the range as one side of the triangle and the height to which the ball would have risen had gravity played no part in the ball's flight as the other side. The latter side of the triangle is found by using the formula S equals $\frac{1}{2}gt^2$ where "S" is the distance through which gravity moved the ball, "g" is the acceleration of gravity, and "t" is the time the ball is in the air. Again by using trigonometric functions, the angle of impact is determined and also the distance that the ball could have traveled in the direction imparted by the club head if gravity had no effect. This latter distance is the hypotenuse of the triangle. The hypotenuse divided by the time that the ball is in the air determines the average velocity of the ball as imparted by the club head. These calculations are based upon the assumption that the ball did not slice or hook. However, at a distance of 300 feet an additional 15 feet makes but

one degree error in the angle of impact calculation and a difference of 3 feet per second in the velocity. The four measures that have now been calculated are the range, velocity, angle of impact, and the angle of deviation to the right or left of the intended line of flight.

Tables were constructed to enable direct transposition of the recorded data to the calculated measurements shown in Diagrams 1 and 2.

COTTON BALLS

Equipment and Lay-out of the Test:

1. Area 20 x 30 yards.
2. Three tape measures. One tape is attached to the floor or ground at the point from which the ball is to be hit in such a manner that the tape may be moved back and forth to measure the range directly. The other two tapes are placed at a point 40 feet from the point of impact with the zero end of each tape placed upon the line designating the desired line of flight. These tapes are then stretched at right angles to the desired line of flight and are used to measure the deviation to the right or left.
3. One fast stop watch.
4. Cocoa mats if the test is administered indoors.
5. Two dozen cotton balls. The balls were in good condition but no attempt was made to continually introduce new balls as this would not be possible in many school situations.
6. One number five iron.
7. Three administrators, one to measure the range, one to measure the deviation, and one timer and recorder.

The Test.—The test consisted of twenty trials, each trial consisting of one full-swinging shot. A ball which was in the air less than .4 second was not counted as a trial. As each trial was taken, the tape measure attached to the floor at the point of impact was moved to the place that the ball first touched the floor. The range was thus measured directly. The deviation to the right or left was determined at the point that the tape measuring the range intersected the tape measuring the deviation. The time that the ball was in the air between the moment of impact and first touching the floor was determined by the use of the stop watch.

Treatment of Data.—The range is measured directly in this test, thus saving one set of calculations made necessary in the hard-ball test because of the much greater distances involved. The angle of deviation is determined by constructing a right triangle using the straightaway distance of 40 feet where the tapes measuring deviations were placed as one side, and the measured deviation from the line of flight as the other side. Trigonometric functions are employed to determine the angle of deviation. The angle of impact and velocity are calculated by the same methods used in the hard-ball test.

RESULTS AND CONCLUSIONS

Results for the Hard-Ball Test.—The test was given to women students and faculty at the University of Wisconsin using both the number two and the number five irons. There was a wide range of experience and skill among the subjects. The reliability coefficients that were found are shown in Table I.

TABLE I

RELIABILITY OF THE HARD-BALL TEST CALCULATED FROM THE AVERAGE OF THE TEN ODD- AND THE TEN EVEN-NUMBERED TRIALS

Number of Subjects	*Club*	*Range*	*Velocity*	*Angle of Impact*	*Angle of Deviation*
30	No. 2	.92	.86	.81	.82
30	No. 5	.95	.89	.89	.60

Conclusions Regarding Hard-Ball Test.—Range as a measure of the result of the full-swinging shot in golf is highly reliable. This reliability compares favorably with the reliability of the range plus the roll found in other golf research in which the reliability found by correlating the total yardage of ten odd-numbered trials with the total yardage of ten even-numbered trials was .90.[2]

The velocity and angle of impact have a good reliability but not as high as the range. This is to be expected as these two elements are the components of the range. This is in harmony with the results of a study of testing the approach shots in golf in which it was discovered that the more elements of a skill that can be included in the construction of a target the more reliable the test.[3]

The angle of deviation appears to be less reliable than the other three measurements. This is not unexpected considering the number of elements which may cause the deviation; to name only a few, stance, incorrect club head position at address, incorrect grip, and faulty swings.

As for the differences in the coefficients between the number two iron and the number five iron, it is believed that the psychological side of golf is a factor here. The majority of the subjects expressed dissatisfaction at having to use the number two iron, saying they "just couldn't hit a thing" with that club. For that reason most of them chose to use the number five iron first, a fact which might explain the higher correlation with the number two iron in the angle of deviation to the right and left. The preliminary test with the number five iron gave them practice in lining up and preparing for their shot.

[2] Elizabeth B. Autrey. A study of a battery of tests for measuring playing ability in golf. Unpublished master's thesis, University of Wisconsin, 1937.

[3] Harriet Watts. Construction and evaluation of a target for testing the approach shot in golf. Master's thesis, University of Wisconsin, 1942.

The validity of the test is inherent in the test because the skill being tested was used in its entirety as the test itself.

Results for the Cotton-Ball Test.—This test was given to women students and faculty at the University of Wisconsin, once in the fall to forty-four subjects and again in the spring to thirty subjects. The number two and the number five irons were used both times. The reliability coefficients found are shown in Table II.

The validity of the cotton-ball test was determined by correlating the average of the twenty trials with the cotton balls with the average of the twenty trials with the hard balls in each of the four calculated measurements. There was an interval of one to two weeks between the taking of the two tests by each subject.

A further study of the validity of cotton balls was prompted by the possibility that the validity coefficients might be affected by the time interval between the hard- and cotton-ball test. In another test of the full-swing shot in golf,[4] it was found that the reliability of a distance-driving golf test using hard balls was .90 for ten trials when the odd and even trials were correlated. Using the same test with one week intervening between the two tests correlated, the reliability was found to be only .72.

TABLE II

RELIABILITY OF THE COTTON-BALL TEST CALCULATED FROM THE AVERAGE OF THE TEN ODD- AND THE TEN EVEN-NUMBERED TRIALS

	Club	*Ten Trials*	*Ten Trials*	*Predicted for 20 Trials**
Number of Subjects		30	44	44
Range	No. 2 iron	.84	.84	.91
	No. 5 iron	.81	.88	.93
Velocity	No. 2 iron	.69	.80	.89
	No. 5 iron	.70	.73	.84
Angle of Impact	No. 2 iron	.79	.75	.86
	No. 5 iron	.81	.82	.90
Angle of Deviation	No. 2 iron	.45	.79	.88
	No. 5 iron	.50	.68	.81

* Calculated from the Spearman-Brown Prophecy formula.

Fifty-five subjects, women students and faculty of the State College of Washington and the University of Idaho, and six members of the Pullman Women's Golf Club, were used in this second study of validity. As at Wisconsin, there was a wide range of experience and skill among the subjects. Due to the high reliability previously found, ten trials with the number five iron were given in this test. The validity was determined by correlating the average of the ten trials with the cotton balls with the average of the ten trials with the hard balls. The tests were given immediately following each other.

[4] Autrey, *op. cit.*

The validity coefficients resulting from the two studies of validity are found in Table III.

TABLE III

VALIDITY OF THE COTTON-BALL TEST

Number of Subjects	*Interval Between Tests*	*Club*	*Number of Trials*	*Range*	*Velocity*	*Angle of Impact*	*Angle of Deviation*
30	1-2 Weeks	No. 2 iron	20	.65	.42	.31	.17
30	1-2 Weeks	No. 5 iron	20	.49	.44	.33	.14
55	none	No. 5 iron	10	.73	.53	.61	.39
55	none	No. 5 iron	10*	.80	.66	.72	.62

* Correcting for attenuation assuming that the reliability of the test given at the State College of Washington is the same as the reliability of the test given at the University of Wisconsin in correcting both x and y.

Conclusions Regarding Cotton-Ball Test.—The range has good reliability for ten trials and is predicted to be highly reliable for 20 trials. As with the hard balls, the velocity and angle of impact and the angle of deviation have lower reliability than the range but are still high enough to be acceptable. The reliability coefficients are lower in the cotton-ball test than in the hard-ball test. This is to be expected because there is more variation among the balls and in the amount of deformation upon impact with the club.

The validity of the range is sufficiently high to warrant the consideration of the cotton-ball test as a measure of skill in the full-swing shot in golf. The validity coefficients of the velocity, the angle of impact, and angle of deviation reflect positive relationships but the diagnostic value of the test is impaired. These measurements should be taken only if the results will be interpreted with an understanding of their limitations. The lower correlation of the angle of deviation may be due to a combination of several factors. First, the angle of deviation had the lowest of all the reliability coefficients. Second, the designated line of flight for the cotton-ball test was indicated by an object placed upon the ground approximately sixty feet from the point of impact. It may have been more difficult for some students to line up with this target than it was to line up with the rope used in the hard-ball test. Third, there is a noticeable tendency for some subjects to "press" which affects the accuracy of their swing. From observation, this appeared to be especially true if the hard balls were not going the distance the subject thought they should.

SUMMARY

The hard-ball test as described is a reliable and valid measure of the range, velocity, and angle of impact in the full-swing shot in golf. The angle of deviation is less reliable, but it is high enough to

be usable. As a practice-motivating factor, the latter is important in encouraging students to take more care in lining up their shots.

In the cotton-ball test the range is a reliable and valid measure of the result of the full-swing shot in golf. The diagnostic value of the test is impaired because of the lower validity coefficients found for the velocity, angle of impact, and angle of deviation. These measures are not an infallible indication of the source of difficulty, but as supplementary to the teacher's analysis may be helpful in giving the student an understanding of these elements in relation to the result of the shot. This may be carried over into understandings with regard to choice of club for various distances and approach shots.

A total of ten trials is a sufficient number for both the hard- and cotton-ball test. In either instance the test as given on one day should not be considered an infallible indication of a player's average skill. It is only an indication of skill on a particular day; this may be well above or below his own average ability.

The value of the cotton-ball test should not be overlooked for it has many advantages over the hard-ball test. Due to the smaller area involved it is easier to administer and is more economical of time. The test can be permanently set up in one corner of the practice range thus allowing the students to test themselves frequently without disrupting the practice of the class.

The reliability correlations were undoubtedly influenced in a higher direction by the wide range of skill of the subjects although the reliability correlation of the range was similar to that of a comparable measurement in the Autrey study. However, the ease of administration of the cotton-ball test makes it possible to obtain a still more reliable score by averaging the results of several repetitions of the test. Frequent repetition of the test will also provide a measure of progress for the students and in so doing be motivating to them, and also be a measure of the student's consistency, inasmuch as her daily fluctuations in skill will be revealed. The more often testing is done, the greater the aid should be to the teacher in evaluating the success of her method of teaching throughout the unit. The cotton-ball test also lends itself to both outdoor and indoor testing. The latter is of value for those schools which find it necessary to conduct all or part of their golf program indoors.

An Analysis of the Value of Dry-Skiing In Learning Selected Skiing Skills

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(Submitted for publication July, 1949)

STATEMENT OF THE PROBLEM

THE purpose of this study was to determine the value of dry-skiing in the actual learning of skiing skills. Is it possible to teach body position and body movements so that a minimum amount of time will be spent in applying these skills learned indoors to the actual skill of skiing?

So far as the writer can ascertain, no studies have been made to determine the value of dry-skiing in learning skiing skills although Prager states:

> Novice skiers have something more interesting to look forward to in pre-season training than general exercises. "Dry-skiing" may be taken as a dessert after a solid meal of gymnastics and training, and should be taken only so.[1]

Stanford University is one of the many educational institutions using a dry-skiing course. At Stanford it is offered as a regular physical education credit class under the auspices of the physical education department. The purpose of the course is "to condition and limber the students for the activity, in order that they may be able to make the most of their few coveted weekends in the mountains."[2]

The dry-skiing course reported in this study did not attempt to condition the individual for skiing but emphasized the correct body positions and body movements which are necessary for the snowplow, snowplow turn, and stem turn.

METHODS AND PROCEDURES

In approaching the study, the equivalent-group experimental technique was used to determine the amount of skill college girls acquired in dry-skiing classes as contrasted with a similar group which did not have such instruction before participating in regular skiing classes outdoors on the slopes. Thirty-two college girls participated in the experiment, each choosing to do so voluntarily. One-half of

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This study was completed as a thesis for the master's degree at Springfield College, Springfield, Massachusetts, 1948.

[1] Walter Prager. *Skiing.* New York: A. S. Barnes and Co., 1939, p. 5.

[2] Luell A. Weed, "Snow or Straw—We Ski!" *Journal of Health and Physical Education,* 11:1 (January, 1940), p. 27.

the subjects constituted the experimental group, and the other half, the control group.

The subjects used in the study were all non-skiers at the Johnson Teachers College, Johnson, Vermont. Every attempt was made to eliminate from the study any girls who had had previous skiing experience, so that initial skiing skill would be constant at the start of the experiment.

Equating the Groups.—In dividing the thirty-two girls into experimental and control groups, the problem of how best to do this was considered. There are a number of factors which are of importance in learning to ski, such as balance, strength, agility, coordination, and endurance. After consideration of these factors, a test of motor educability was chosen. Motor educability is defined by McCloy as "the ease with which an individual learns new skills."[3] The decision was based upon the following considerations: (1) motor educability includes elements of strength, agility, and coordination; (2) valid and reliable tests of motor educability are available; and (3) it would have been impracticable to equate the group on separate bases of strength, agility, and coordination because of the small number of students available, absence of testing equipment, and lack of trained personnel.

The Metheny modification of the Johnson Motor Educability Test[4] was chosen to equate the two skiing groups. This modification was found by Metheny to obtain approximately the same results as the entire Johnson battery. The means and standard deviations of the two groups of sixteen girls each as equated on the basis of this test are as follows:

	Control Group	*Experimental Group*
Mean	22.75	22.88
Standard deviation	2.77	2.76

Controls Used in the Study.—As many factors as possible were controlled:

1. All participants in the study were non-skiers.

2. The skis were kept in the custody of the instructors at all times other than for practice sessions and the subjects were unable to obtain other skis. They were distributed each day at a designated time and place.

3. Practice was limited to one hour under the guidance of the instructors. No one was permitted more than one hour of practice each afternoon, and each student was restricted to the same number of trials in running the course.

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[3] H. Harrison Clarke. *The Application of Measurement to Health and Physical Education.* New York: Prentice-Hall, Inc., 1946, p. 240.

[4] Eleanor Metheny, "Studies of the Johnson Test as a Test of Motor Educability," *Research Quarterly,* 9:4 (Dec., 1938), p. 105.

4. Each group was not present at any instruction period of the other group.

5. The same instructors were used for both groups so there would be no deviation in the method or technique of presentation.

6. Before the study was started the instructors met and were carefully given instructions as to the method and materials to be presented. The instructors also met each day after the practice sessions and discussed and recorded progress.

7. All skis were equipped with cable bindings and kept waxed and in good condition by the instructors.

Procedure with Control Group.—The control group received ski instruction on the open slope with no previous instruction whatsoever. They received one hour of ski instruction each day for ten consecutive days.

Procedure with Experimental Group.—The experimental group received one-half hour of dry-skiing instruction each day for a period of six days, a total of three hours. Emphasis was placed on the correct body position and weight distribution with reference to the downhill running position, snowplow, snowplow turn, and stem turn. They were drilled constantly in these skills, and at the end of the six periods all subjects seemed to have a sound knowledge of what should be done.

Following the dry-skiing drills, the experimental group was given ski instruction on the open slope.

Procedure Used for Determining Progress on the Open Slope.—Certain standards of achievement were set up. Each participant attained these before being permitted to progress to the next skill level. These were as follows:

1. Snowplow: The individual was requested to start in a downhill running position, pick up some speed and then push out into a snowplow position and come to a stop at a designated spot. It was a question of either passing or failing. If successful, the individual progressed to snowplow turns; if unsuccessful, additional practice was required.

2. Snowplow turn: Here the individual was required to link snowplow turns, showing ability to turn right and left. It was also required that the turns take place at designated spots plainly marked by flags. If the subject went beyond the designated points, additional time was spent on snowplow turns. If successful, the subject advanced to stem terms.

3. Stem turns: The requirements for the stem turn were the same as for the snowplow turn. That is, the turns had to be linked and it was required that they take place at designated spots on the slope.

RESULTS OF THE STUDY

Snowplow.—A comparison of the results of ski instruction for the experimental group and the control group in learning the snowplow appears in Table I.

TABLE I

COMPARISON OF EXPERIMENTAL AND CONTROL GROUPS IN LEARNING THE SNOWPLOW

Control Group		*Experimental Group*	
Total number of hours	67	Total number of hours	23
Mean	4.125	Mean	1.469
Standard deviation	.992	Standard deviation	.674
Difference between means			2.656
Standard error of difference between means			.305

In learning the snowplow the total number of hours required by each group indicates the advantages of dry-skiing in learning this skill. There is a forty-four-hour difference between the two groups. The actual difference between the two means is 2.656 hours and the standard error of the difference is .305. When the formula $\frac{D}{\sigma d}$ is applied, the resulting critical ratio is 8.7.[5] From the above evidence one can be practically certain that dry-skiing is definitely advantageous to the individual in learning the snowplow.

Snowplow Turn.—A comparison of the results of ski instruction for the experimental group and control group in learning the snowplow and the snowplow turn appears in Table II.

TABLE II

COMPARISON OF EXPERIMENTAL AND CONTROL GROUPS IN LEARNING THE SNOWPLOW TURN

Control Group		*Experimental Group*	
Total number of hours	45	Total number of hours	28.25
Mean	2.813	Mean	1.766
Standard deviation	.496	Standard deviation	.4
Difference between means			1.047
Standard error of difference between means			.161

In learning the snowplow turn the experimental group has a definite advantage in total number of hours used in learning the skill. Although the difference is not as great as in the snowplow, this skill was learned in 16.75 hours less than the time required by the control group. The difference between the means is 1.047 hours and the standard error of the difference is .161. Applying the

[5] H. E. Garrett. *Statistics in Psychology and Education.* New York: Longmans, Green and Company, 1926, p. 133.

formula $\frac{D}{\sigma d}$, the resulting critical ratio is 6.3.[6] The critical ratio is not as great as that in learning the snowplow but it is statistically significant. One can be practically certain that dry-skiing is definitely advantageous to the person just learning to ski.

Stem Turn.—A comparison of the results of ski instruction for the experimental group and the control group in learning the snowplow, the snowplow turn, and the stem turn appears in Table III.

TABLE III

COMPARISON OF EXPERIMENTAL AND CONTROL GROUPS IN LEARNING THE STEM TURN

Control Group		*Experimental Group*	
Total number of hours	33	Total number of hours	27.25
Mean	3.3	Mean	2.725
Standard deviation	.458	Standard deviation	.326
Difference between means			.575
Standard error of difference between means			.187

Since only ten of the sixteen in the control group learned the stem turn it was necessary to obtain the mean and standard deviation by using the ten successful ones and discounting the other six. The mean and standard deviation for the experimental group was obtained by selecting those individuals whose rank equaled the successful, controlled group skiers on the Motor Educability Test. That is, since number four of the control group was not successful in learning the stem turn, number four of the experimental group was not used in computing the mean and standard deviation. The same elimination applied to the other five unsuccessful subjects of the control group and to the corresponding individuals in the experimental group.

The difference in total hours, 5.75, therefore, is not quite as striking as it is in the snowplow and snowplow turn, although, had all of the control group been successful in learning the stem turn, the difference in total hours would have been greater. The difference between the means is .575 hours and the standard error of the difference is .187. Applying the formula $\frac{D}{\sigma d}$, the resulting ratio is 3.0.[7] Although not as great as the first two skiing skills, it is large enough to have significance. One can be practically certain that dry-skiing is advantageous in learning the stem turn.

SUMMARY

The results of this study indicate that a course in dry-skiing would be advantageous to the beginning skier. The effectiveness of the dry-skiing is explained in part by the following factors.

[6] *Ibid.*
[7] *Ibid.*

1. It appears that confidence is built up within the individual to the extent that the subject feels that he or she can do the skills being taught even though the individual has never attempted them under actual skiing conditions.

2. Since body positions and body movements are already learned thoroughly before being exposed to actual skiing on the snow-covered slope, the subject is not forced to concentrate on too many factors related to what is being taught and is able to concentrate on balance while in motion.

3. The majority of the skiers in the United States can be classified as recreational skiers and since many enthusiasts ski only on weekends, a dry-skiing course should afford opportunities for many of those weekend skiers to increase their skills during the week in this winter sport.

4. Dry-skiing could be introduced into the physical education curriculum to the advantage of pupil and instructor. The novice skier should have body position, movement, and balance stressed, whereas for the intermediate and expert skier conditioning exercises should receive more attention.

A Physical Fitness Knowledge Test For Secondary School Boys and Girls

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(Submitted for publication, August, 1949)

WITH the emphasis that has been placed on physical fitness there has developed a need for a test which would determine the amount of knowledge of desirable practices in physical fitness possessed by students. This study was conducted with that end in view. The proposed test is expected to determine the ability of students to choose the most desirable practice in physical fitness as it is applied to a specific situation. It is hoped that the total score will, in general, reflect the habits, knowledge, and experiences of students.

Since physical education is a vital part of the normal student's life he should know not only games and activities but the more common psychological and physiological implications of activities of various kinds. To determine the effectiveness of a teaching program in physical or health education, the teacher should have some measuring device to determine *what* the student knows and whether he can apply his knowledge to a practical situation. This test will be of assistance to the teacher as well as the student in determining knowledge of desirable practices in physical fitness.

The literature reviewed prior to the construction of this test failed to disclose any other test of its kind. In the proper development of a test the first concern should be to establish the validity of the test items. This was done by submitting a preliminary test of 148 questions to competent persons in the field of physical fitness, physical education, and physiology.[1]

The preliminary test was also submitted to graduate classes in physical fitness and the controversial or too difficult items eliminated or revised. From the results obtained from these discussions a final test of 100 questions was made. The information for the questions was gathered from graduate courses, observations, and reading the experiments conducted in the physical fitness labora-

[1] Dr. R. M. Melampy, department of physiology, University of Illinois; Paul Hunsicker, Darrell Latham, Ben Massey, Warren Huffman, Tom Buckley, M. R. Garret and Darrell Green, instructors in physical education and members of the professional research staff in physical fitness at the University of Illinois. Nutritional questions were checked by Dr. Connor Johnson, of the University of Illinois Nutrition Laboratory.

tory at the University of Illinois, personal notes, and suggestions gathered from a review of fitness programs recommended for secondary schools.

The final test items were all validated by reference to reliable books and magazine articles [2,3,4,5,6] and the pooled judgment of competent persons. As a further aid in determining the type of test needed, content of the proposed test, subject matter to be included, scope of the test, need for and value of such a test, certain authorities in the field of health, physical education, and physical fitness critically appraised the test.[7]

The test was administered to the junior and senior boys and girls of the Champaign and University High Schools in Champaign-Urbana, Illinois. A total of 333 students took the test of which 153 were boys and 180 were girls. Frequency distributions were made for the two groups as well as a distribution for the combined boys' and girls' scores. The reliability of the test was determined by the split-halves method, stepping up the reliability by use of the Spearman-Brown prophecy formula. The reliability, mean, and sigma[8] of the obtained scores are as follows[9]:

	Cases	*Mean*	*P.E. of Mean*	*Sigma*	*Reliability*
Boys	153	72.76	±.83	15.27	.94
Girls	180	65.00	±.81	16.05	.96
Combined	333	68.55	±.56	15.30	.95

Great care was exercised to be certain this was a test of physical fitness knowledge rather than of vocabulary. *The Teacher's Word Book of 30,000 Words*[10] was consulted as a possible aid in this specific problem. This type of tabulation refers to the frequency of occurrence of words rather than difficulty but frequency may not

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[2] T. K. Cureton. *Physical Fitness Appraisal and Guidance.* St. Louis: C. V. Mosby Company, 1947.

[3] F. W. W. Griffin. *The Scientific Basis of Physical Education.* London: Oxford University Press, 1937.

[4] A. H. Steinhaus. "Fitness and How We May Obtain It," *Journal of Health and Physical Education,* 14:456 (October, 1943).

[5] Jokl, Ernest. "Physical Fitness," *Journal of American Medical Association,* 116:2388, May 24, 1941.

[6] C. E. Best and N. B. Taylor. *The Physiological Basis of Medical Practice.* Baltimore: The Williams and Wilkins Company, 1945.

[7] Dr. Karl W. Bookwalter, University of Indiana; Dr. D. K. Brace, University of Texas; Dr. F. W. Cozens, University of California; Miss Ruth B. Glassow, University of Wisconsin; Dr. Leonard A. Larson, New York University; Dr. C. H. McCloy, State University of Iowa; Dr. N. P. Neilson, University of Utah; Mr. F. S. Stafford, U. S. Office of Education; and Dr. A. H. Steinhaus, George Williams College.

[8] Statistical procedures used in this test have been obtained from H. E. Garret, *Statistics In Education and Psychology,* New York: Longmans Green and Company, Third Edition, 1947; Also, K. J. Holzinger, *Statistical Tables for Students in Education and Psychology,* Chicago: The University Press, 1931.

[9] All statistical data were checked by Miss Marie Boddy, statistical clerk in the Research Department, School of Physical Education, University of Illinois.

[10] E. L. Thorndike and Irving Lorge. *The Teacher's Word Book of 30,000 Words.* New York: Bureau of Publications, Teachers College, Columbia University, 1944.

be the same as difficulty and it is often the sentence or context in which a word appears that determines its difficulty. In an attempt to be purely objective in determining the difficulty of the test, recourse was made to *The Art of Plain Talk*.[11] The author has proposed a mathematical formula whereby a difficulty score for any reading matter may be computed. By the use of this formula a difficulty score of 2.94 was computed for this test. The determination of the affixes to be used in this formula was computed by two assistants in the department of English, University of Illinois.[12] A score of 2.94, which is equivalent to the sixth-grade level, indicates that the subject matter, insofar as context difficulty is concerned, presents no problem to the average high school boy and girl.

The test has been designed for 40 minutes of working time. It is relatively easy to score. By placing the test form over the answer key and allowing the answer column corresponding to the question page to appear each answer may be quickly scored. It is recommended that only wrong answers be checked; omissions are treated as wrong answers. To obtain a score the number of wrong answers is subtracted from 100. To obtain a letter grade or standard score the obtained total may be compared with the tables.

The answer key is constructed so that when the test form is placed over it the correct answer is exactly opposite the question. As an aid toward insuring accuracy the answers have been numbered to correspond with the test questions. There are the same number of answers per column as there are questions per page. It is estimated that the average person, after a little practice, will be able to score 40 tests in an hour.

It is recommended that the test be given in a large number of schools and the results obtained be sent to the authors for use in revising the norms and standards.[13]

A Physical Fitness Knowledge Test for Secondary School Boys and Girls

A Few Illustrative Questions

1. Physical fitness, in addition to being free from sickness and the ability to pass a medical examination, means:
   1. Condition to run a mile under four minutes.
   2. Ability to handle the body well and capacity to work hard over a long period of time without diminished efficiency.
   3. Having large bulky muscles.
   4. Having long arms and long legs.
   5. Being far-sighted.

[11] Rudolph Flesch. *The Art of Plain Talk*. New York: Harper and Brothers, 1946.
[12] L. M. Magill and E. W. Robbins.
[13] Percentile tables for high school boys and girls have been constructed on the basis of the data collected up until the time of publication of the test. Interested persons can secure copies of the test and the scoring key from the authors.

5. At the end of any activity involving strenuous running a person should:
   1. Stop immediately and sit down.
   2. Lie down and cover up with a blanket.
   3. Allow someone to massage the muscles.
   4. Jog slowly and do flexing exercises for about 10 minutes.
   5. Stand still and take deep breaths.

10. If a normal individual experiences stomach sickness and headache after strenuous exercise at the start of a season of training it usually indicates:
   1. Something very wrong with the heart.
   2. A temporary lack of condition.
   3. That the individual should stop all exercise.
   4. Food poisoning.
   5. That the person should go to bed for at least a month and rest.

15. The aches and pains in muscles usually suffered by an individual following strenuous exercise for the first time are caused by:
   1. Lack of water in the blood.
   2. Lack of sleep the night before.
   3. Lack of sufficient heart rate.
   4. Improper method of performing activity.
   5. Torn muscle tissues and accumulation of waste products.

24. Prolonged inactivity generally affects organic and muscular efficiency in a way which tends to produce:
   1. No marked effect if the person had been in good condition.
   2. A slight increase in efficiency.
   3. A weakness and a decrease in efficiency.
   4. A reduction in the amount of fat deposited around organs and muscles.
   5. An increase in the ability of the nervous system to react to a stimulus.

30. A simple method of self-testing to determine one's circulatory-respiratory condition is:
   1. To see if one can run up a flight of stairs in 10 seconds.
   2. Determine how long one can hold his breath after running in place for two minutes.
   3. To exercise for one minute, then measure the trunk flexion.
   4. To see how many push-ups one can do in two minutes.
   5. To see if one can walk a straight line after turning around ten times in rapid succession.

40. The best way of developing muscular endurance is:
   1. To do stretching exercises for 3 minutes daily.
   2. Go "all out" the first day and gradually taper off.
   3. At each exercise period go beyond the first onset of fatigue.
   4. When the body feels comfortably tired stop and rest.
   5. Be sure the body is thoroughly warmed up before beginning exercise.

49. In order to become physically fit quickly a person with no organic trouble should:
   1. Do light calisthenics.
   2. Practice volleyball and shuffleboard.
   3. Engage in badminton or tennis.
   4. Play three sets of tennis daily for three weeks.
   5. Practice "all out" exercises.

57. Many normal people complain of always having a "tired" feeling. This could probably best be aided by:
   1. Taking additional doses of vitamin pills.

2. Drinking two quarts or more of water daily.
3. Taking regular exercise daily in the outdoors.
4. Increasing the amount of vegetables in the diet.
5. Taking regular massage treatments.

61. Before entering upon any program designed for strenuous conditioning or competition each participant should:
    1. Purchase the type of athletic equipment needed for the activity.
    2. Be examined by a physician for his own protection.
    3. Be sure he understands all the movements or exercises to be undertaken.
    4. Obtain an accident and health insurance policy.
    5. Inform the athletic director as to his interest in the program.

72. Many complaints of eye trouble, headache, nervousness and fatigue could be best remedied by:
    1. Taking aspirin or other sedatives.
    2. Recreation, physical conditioning, adequate diet and sleep.
    3. Eating fish since it is a brain food and will help the nerves.
    4. Taking laxatives to clean out the bodily poisons.
    5. Seeing an optometrist.

Research Abstracts

Prepared by the

RESEARCH ABSTRACTS COMMITTEE OF THE

NATIONAL COUNCIL OF THE RESEARCH SECTION

CAROLYN W. BOOKWALTER, *Chairman*

ANATOMY

1. Schlegel, Jorgen U. Demonstration of blood vessels and lymphatics with a fluorescent dye in ultraviolet light. *Anat. Rec.*, 105:3 (November, 1949).

An attempt to demonstrate blood vessels has been made by means of injecting fluorescent material intravenously. In anesthetized female rabbits 10 cm^3 of a saturated solution of thioflavin S were injected into an ear vein. Simultaneously microscopic observation of blood vessels in different organs had been made. The light source was reflected ultraviolet light.

After injection of 2 cm^3 the blood vessels show up as shining channels, clearly contrasting with the black-appearing stroma. The dye seems to become localized on the walls of the vessels for one or two minutes. After that time, nothing is seen in the vessels, all the thioflavin having now diffused out into the tissue. At this stage the blood vessels appear black, in contrast to the stroma which is brilliant. Later on the thioflavin is taken up by the lymphatics, which then appear as clearly illuminated channels. Samples of tissues have been taken according to the Gersh technique, i.e., frozen in situ with isopentane chilled down with fluid nitrogen, dehydrated at a temperature at around —40°, embedded in paraffin and cut in sections of ten to one hundred μ in thickness. After clearing in xylol it is possible, by means of ultraviolet illumination, to see all the vessels which were actively functioning in vivo, whether or not they contain blood.—*The Wistar Institute.*

EDUCATION

2. Ivins, W. H., W. H. Fox, and D. Segel. A study of a secondary school program in light of characteristics and needs of youth. *Bulletin of the School of Education, Indiana University*, 25, 6:1-69 (November, 1949).

Differential Aptitude Tests, the Cooperative Reading Comprehensive Test (C-1), the Kuder Preference Record, and the California Mental Health Analysis were administered to 81 boys and 102 girls of fourteen years of age and to 48 boys and 49 girls of seventeen years of age in a large consolidated high school in Indiana during January, 1949. Questionnaires in different word form were filled out by the students, the parents, and the teachers. The seventeen-year-old boys appeared to be low in the aptitude and reading tests. Boys and girls were low on language usage. Boys were high in artistic activity preference. Girls were superior to boys in numerical ability, abstract reasoning, mechanical ability, and clerical speed and accuracy. The fourteen-year-old girls ranked highest in the literary activities. Both groups of girls and the seventeen-year-old boys showed low interest in outdoor activities. Girls were lower than boys in having a feeling of satisfaction in work and recreation. The seventeen-year-old girls ranked very high on outlook and goals.

Few boys and girls seemed to feel that their school marks were higher or lower than they deserved. Nine out of ten parents were satisfied with the marks assigned the children.

Parents heavily favored combination of parents and teachers for dispensing sex information, though the largest percentage of students indicated that they were receiving sex information only from parents.

Older students favored fewer home duties than did the younger students. Teachers were inclined to favor many duties at home for the students.—*Carolyn W. Bookwalter.*

3. Radke, Marian, and Jean Sutherland. Children's concepts and attitudes about minority and majority American groups. *J. Educ. Psych.*, 40: 449 (December, 1949).

This study attempted to discover the meaning of "American" to a group of school-age children and to determine some of their attitudes, specifically those toward Negroes and Jews.

Two hundred and seventy-five children in grades five through twelve were asked to answer a questionnaire concerned with the problem. These children were from a small mid-western town with a fairly homogeneous background. The town is prosperous, has no Negro residents and only one Jewish family, which is childless.

Analysis of the answers on the questionnaire reveals that most of the children have little understanding of cultural similarities or differences among people. The meaning of "American" does not seem to be identified with ideals of human welfare or equal rights and opportunities for all groups. Prejudices acquired by these pupils were not learned through personal contact with the minority groups concerned, but must have come from other sources.

Reactions expressed by some of the older children against minority groups are too reminiscent of those found in totalitarian countries.

Parents, teachers, and the church have failed badly in instilling sound ideals of Americanism, democracy, and the value of human relationships in these children.—*Marjorie Phillips.*

HEALTH

4. Green, J. S. The postlaryngectomy clinic of the National Hospital for Speech Disorders: a statistical study of 300 patients. *New York State J. of Med.*, 48, 20: 2398-2404, 1949.

A brief history is given of the techniques employed in laryngectomy and voice re-education is presented with detailed findings on 302 patients who received training in esophageal speech. The majority of patients were men of 50-70 years of age and of the lower economic bracket. As a result of this program 70 percent were able to return to their former jobs or to some other occupation.—*Alma C. Kelly.*

5. Riesch, K. P. A study of some factors in pupil growth. *J. Exper. Ed.*, 18: 31 (September, 1949).

The purpose of this investigation was to study certain factors which were thought to be related to the social and scholastic development of pupils. Factors studied were intelligence, past achievement as measured by pre-test scores on measures of social adjustment, personality, conduct, attitude toward the teacher, type of school, and teaching efficiency.

Suitable tests for the measurement of each of the factors were administered, with a three-month period elapsing between administrations. A total of 258 subjects completed both tests, all of whom were seventh- and eighth-grade students.

Critical ratio and correlation techniques were used in analyzing the data.

Results revealed that significant positive changes in conduct and achievement occurred during the three-month period, but no significant changes were noted in personality, adjustment, or attitude toward the teacher. Gain in achievement has low but significant correlations with pre-tests of conduct, social adjustment, and personality. Teaching efficiency measured in terms of residual pupil gain is significantly related (5 percent level) to pupil achievement. No significant differences were found in attitudes, adjustment, and personality between rural and urban pupils. On the basis of tests used it is impossible to predict gain in achievement or teaching efficiency with acceptable accuracy.

Tests such as the Washburne Social Adjustment Inventory, Wood Right Conduct Tests, and California Test of Mental Maturity when administered to teachers are not significantly related to either the superintendent's evaluation of the teacher or the criterion of residual pupil gain. The same is true of the factors of age, teaching experience, and pre-service education.—*Marjorie Phillips.*

6. Simonton, Kinsey M. Types of vertigo. *Modern Med.*, 17, 24: 66, 1949. (Original article in *Ariz. Med.*, 6:28-33, 1949.)

The author stresses the necessity of an accurate description of the complaint before the physician can determine the cause of the dizziness, or of the vertigo. He points out the difference in the meaning and lists with brief descriptions nine of the most common causes.—*Alma C. Kelly.*

7. Stinchfield, F. E. Traction and suspension for fractures. *Modern Med.*, 17, 24:74-78, 1949. (Original article in *Southern Med. Jr.*, 42:770-776, 1949.)

Diagnosis and descriptions are given for the type of traction advocated. Preference for skeletal traction (vs. skin traction) in cases requiring heavy weight is explained. Amount of weight used varies with the duration of time since the injury occurred, but excessive traction must be avoided as it is one of the main causes of delayed union or non-union.—*Alma C. Kelly.*

8. Wilkerson, Hugh L. C. Diabetes control in the public health program. *New York State J. of Med.*, 49, 24:2945-2952.

The author, engaged in the Diabetes Branch, U. S. Public Health Service, points out why diabetes is such a serious disease, discusses its relationship to other diseases, and tells why he considers this dread disease to be a public health problem. He believes that the cost of continuing diabetes control program would be relatively low where there was cooperation between local health agencies and the community. A strong believer in preventive medicine. Dr. Wilkerson indicates that many busy practitioners are using the schools to educate the rising generation in how to prevent diabetes, and tells how a complete program in this field can be carried out.—*Alma C. Kelly.*

9. Ziskin, Thomas. The hypophyseal area in hypertension. *Modern Med.*, 17, 24:65, 1949.

Research on patients with normal and high blood pressure indicates that the pituitary gland tends to increase with hypertension. To carry on this investigation, skull x-rays were taken on 100 men at Veterans Hospital at Minneapolis. At the time of the experiment, none of the subjects had any indication of glandular trouble. Tables of figures for these findings are included in the article.—*Alma C. Kelly.*

NUTRITION

10. Horwitt, M. K., *et al.* Effects of dietary depletion of riboflavin. *J. Nutrition,* 39: 3 (November, 1949).

Thirty male subjects were divided into two groups of 15 each and fed a diet containing 0.55 mg. of riboflavin for from 9 to 17 months. During this period angular stomatitis, seborrheic dermatitis, scrotal skin lesions, and diminution of ability to perceive flicker were observed. Simultaneous experiments in which the same diet was fed to rats confirmed the inadequacy of the diet. In these animals retardation of wound healing was conspicuous.

Studies of the excretion of riboflavin in the urine suggest that the riboflavin requirement of a resting adult is between 1.1 and 1.6 mg. per day. A reserve of riboflavin cannot be maintained on levels of intake below 1.1 mg. Since previous studies revealed few abnormalities when the intake of riboflavin was above 0.6 mg. per day, it may be concluded that allowances of riboflavin below this amount are insufficient to support normal tissue repair. The type of abnormality then encountered will be dependent upon the trauma, irritation, infection, or other injuries to which the tissues are subjected. Changes in the blood levels of lactic and pyruvic acids were not obtained in diets low in riboflavin, as opposed to the marked changes in carbohydrate metabolism observed during thiamine deficiency.—*The Wistar Institute.*

11. Hove, E. L., D. H. Copeland, and W. D. Salmon. A fatal vitamin E deficiency disease in rats characterized by massive lung hemorrhage and liver necrosis. *J. Nutrition,* 39: 3 (November, 1949).

Young rats died of an acute vitamin E deficiency when restricted to a 10 percent casein diet. Death occurred suddenly in over 75 percent of the male rats between the 6th and 12th week, or after an average of 71 days on the diet. Death was characterized by massive lung hemorrhage, centrilobular or massive necrosis of the liver, and distention of the subcutaneous blood vessels. Protection against the fatal disease was given by alpha-tocopherol or by increasing the casein to a level of 16 percent in the diet. The disease occurred when the casein in the diet was replaced with 16 percent oxidized casein plus 0.3 percent trytophan and up to 1 percent methionine. Cystine was slightly protective, but neither methionine nor theophylline was of benefit when included in the 10 percent casein diet at a 0.1 percent level.—*The Wistar Institute.*

12. McCay, Clive M., and Lois C. Will. Erosion of molar teeth by acid beverages. *J. Nutrition,* 39:3 (November, 1949).

Erosion of the molar teeth of the rat can be detected after the consumption of 10 ml. of acid solutions of the same strength used in cola beverages. A comparative test of acid erosion by natural juices and by phosphoric acid during a period of six months indicated that tomato juice had the least effect and 0.055 percent phosphoric acid the most. Rat teeth subjected to phosphoric acid for this period were eroded nearly to the gum line. Human teeth suspended in cola beverage or its equivalent in sucrose-phosphoric acid gradually lost calcium in the course of two weeks. The buffer capacity of the human mouth against cola beverages differs widely among individuals, but it is fairly constant in a given person. Even after a half minute's exposure some mouths cannot buffer the solution to a pH higher than 3.5, which is considered marginal for erosion. A series of tests indicates that sodium oxalate ingested with food deposits patches on the teeth but is not as effective in the prevention of erosion as oxalic acid dissolved in an acid beverage. Rhubarb juice combined with equal parts of lemon juice protects the teeth against erosion. Neither stearic nor phytic acids prevented

erosion by acid beverages. Oxalate patches could not be deposited on the teeth of steers during a period of one month's feeding of sodium oxalate. No evidence of injury or stone formation was found after feeding adult dogs 100 mg. of sodium oxalate daily for 15 months.—*The Wistar Institute.*

13. Mitchell, H. H., T. S. Hamilton, and Jessie R. Beadles. The nutritional effects of heat on food proteins, with particular reference to commercial processing and home cooking. *J. Nutrition,* 39: 3 (November, 1949).

The effect of heat as applied to food products during commercial processing and home cooking on the nutritive value of the food proteins for the growing rat has been studied on a number of foods by the nitrogen balance method developed in the laboratory. The samples compared were unheated, or very mildly heated as in a solvent-extraction method, and heated to high temperatures by autoclaving in the laboratory (sunflower seed meal), subjection to oil extraction by the expeller process (peanut and linseed meals) or the hydraulic process (cottonseed flour), or subjection to a process of flaking and toasting (corn). As an example of home cooking, the effect of a standard method of roasting on the proteins of beef was ascertained. In all cases, the unheated or mildly heated sample and the highly heated sample were obtained from the same raw material. The percentage of total heat damage was highest for corn (20) and peanut meal (18), intermediate for sunflower seed flour (10) and cottonseed flour (11); no heat damage was demonstrated in the roasting of beef. For flaxseed (linseed) heat exerted a favorable effect on protein utilization (7%), which was especially evident in the improved digestibility of protein. Where heat damage was demonstrated, it related more often to protein digestibility than to biological value.—*The Wistar Institute.*

14. Munro, H. N. The relationship of carbohydrate metabolism to protein metabolism. *J. Nutrition,* 39: 4 (December, 1949).

In a series of N balance experiments adult rats received diets, first, with the carbohydrate given separately from the protein, and then with the carbohydrate fed along with the protein. The immediate effect of this change in the time of feeding carbohydrate was to improve N balance. The improvement was, however, transitory. Subsequent separation of the times of ingestion of the dietary carbohydrate and protein resulted in a transient impairment of N balance. It has been concluded that protein utilization is favorably effected by the presence of carbohydrate in the same meal. In similar experiments involving a change in the time of feeding fat, no evidence was obtained to suggest that protein utilization is altered by the presence of fat in the same meal.—*The Wistar Institute.*

15. Scudamore, H. H., *et al.* Nitrogen balance in men consuming raw or heated egg white as a supplemental source of dietary protein. *J. Nutrition,* 39:4 (December, 1949).

The reported efficiency of utilization of egg white protein on low calorie and low water intakes suggested that it would be a desirable protein for specialized uses by the Armed Forces. However, it was questionable whether or not the moderate heat that could be applied in the manufacture of ration items would be sufficient, either in degree or duration, to destroy the anti-trypsin which is present in commercial egg white powder.

This report describes the results of metabolic investigations designed to determine the importance in human nutrition of this anti-trytic factor. Nitrogen balance was measured in two volunteer subjects consuming a basal diet (protein content, 26.9 gm) to which the following proteins (25-30 gm) were added as successive supplements: (a) lactalbumin, (b) unheated commercial dried egg white, (c) heated commercial dried egg white, and (d) heated commercially

isolated anti-trypsin (ovomucoid). Total fluid intake was 2500 ml. a day.—*The Wistar Institute.*

PHYSICAL EDUCATION

16. Van Dalen, D. B. A differential analysis of the play of junior high school girls. *J. Educ. Res.*, September: 22-31, 1949.

McCloy's Strength Index was administered to 348 girls in grades seven, eight, and nine. The mean average of the girls was 13.5 years. The Physical Fitness Index was derived from the combined scores of right and left grip, back and leg lift, chinning and dipping, and by a norm based on average weight and age.

A play questionnaire including a list of 150 activities was given to the girls so that for every day of one week the students recorded their play participation and the amount of time devoted to each. This procedure was repeated at three-week intervals (September, February, May).

Girls of the two high-strength groups (Strength Index and Physical Fitness Index) exceeded by a minimum of six times the girls of the two low-strength groups in total excess number of frequencies of participation. The girls of the high-strength groups exceeded by a minimum of four times the girls of the low-strength groups in the total excess number of play activities, and three times in the total excess number of minutes devoted to play activities.

Girls in the low-strength groups participated in games which were somewhat individualistic in nature, involved some element of competition, but were distinctly of a lower degree of organization than activities in which girls of the high-strength groups participated. Girls of the high-strength groups participated more frequently in games and activities which required marked muscular strength and large muscle coordination in comparison with girls of low-strength groups. Play activities of a rather restricted range of action, and activities requiring little muscular strength and large muscle coordination were common to girls of the high-strength groups, but decidedly more common to girls of the low-strength groups.—*D. B. Van Dalen.*

PSYCHOLOGY

17. Ammons, R. B. Acquisition of motor skill: II. Rotary pursuit performance with continuous practice before and after a single test. *J. Exp. Psychol.*, 37: 393-411, 1947.

College women (N = 510) were given practice on a pursuit rotor for periods ranging from ⅓ of a minute to 17 minutes, rested for periods ranging from ⅓ of a minute to six hours, and were then given 8 minutes' additional practice. It was found that reminiscence (improvement without practice) was a negatively accelerated function of interpolated rest, reaching a maximum with 8 minutes of practice and a five-minute rest. Recovery from work neared its maximum with 20 minutes of rest, and was an exponential function of time. Maximum accuracy during the standard 8-minute post-rest practice period was influenced by the duration of the interpolated rest, being greatest when the rest was between 5 and 20 minutes. Individual curves were extremely variable—*F. Henry.*

18. Nance, R. D. The effects of pacing and redistribution on intercorrelations of motor abilities. *J. Exp. Psychol.*, 37: 459-472, 1947.

Research in the field of motor ability has persistently indicated that most intercorrelations between motor skills are positive but low. Certain factors such as heterogeneity of maturity and others such as common musculature used in performance may operate to increase intercorrelations in narrow group factors

The present study investigates the influence of *pacing* and *distribution of practice* on the intercorrelations between scores from a rotary pursuit test and a complex coordination test given to some 400 college students. The use of a common procedure in the two tests, e.g., pacing (or distributed practice) failed to increase the intercorrelations; in fact, the correlations were somewhat higher when the conditions were dissimilar in the two tests. Test reliabilities were slightly higher for paced work and distributed practice.—*F. Henry.*

19. Postman, L., and W. O. Jenkins. An experimental analysis of set in rote learning: The interaction of learning instructions and retention performance. *J. Exp. Psychol.*, 38: 683-689, 1948.

Learning efficiency is greatly impaired if there is neither explicit nor self-induced instruction to learn. The results of the present experiment reaffirm the importance of set as a basic determiner of learning performance.

Twenty-five two-syllable adjectives were presented five times to 215 subjects. Set was varied toward anticipation, free recall, and recognition, and retention was tested by these three methods to test the hypothesis that performance would be optimal if the retention test was the one expected and poor if the test was of an unexpected type.

The results show that learning is improved to the extent that the instructions emphasize those aspects of the learning tests that are to be used in the retention test, and impaired to the extent that the instructions and retention problem fail to harmonize.—*F. Henry.*

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Professional and Public Relations: C. O. Jackson.

Professional Education: Rosalind Cassidy.

Research: Carolyn Bookwalter.

Student: Marvell Hancock and Douglas Conner.

Therapeutics: Leah J. Gregg.

District Association Presidents

Central: M. Gladys Scott.

Eastern: Thomas C. Ferguson.

Midwest: Lou H. Hollway.

Northwest: Grace Houghton.

Southern: Solon B. Sudduth.

Southwest: Frank R. Williams.

State Representatives

Central District

Colorado (2): (No report).

Iowa (2): E. F. Voltmer; Frank D. Sills.

Kansas (2): Fritz Knorr; Sue Unruh.

Minnesota (2): Perry J. Sandell; Clarence A. Nelson.

Missouri (2): Deane Smith.
Nebraska (1): Mrs. Herman Gimmestad.
North Dakota (1): Beatrice Wartchow.
South Dakota (1): R. B. Frost.
Wyoming: (None).

Eastern District

Connecticut (2): (No report).
Delaware (1): George W. Ayars.
District of Columbia (2): Joseph Krupa; Mrs. Clarice O. Smith.
Maine (1): (No report).
Maryland (2): (No report).
Massachusetts (3): (No report).
New Hampshire (1): Harry Lehmann.
New Jersey (3): R. Warren Fogerty; Dorothy Simpson; Gerald Garafola.
New York (6): Ellis Champlin; Marie Schuler; John H. Shaw; Jeannette Saurborn; Lloyd Appleton; Carl E. Willgoose.
Pennsylvania (4): Karl C. H. Oermann; Lowell C. Drake; Elmer B. Cottrell.
Rhode Island (1): A. Victor Skonberg.
Vermont (1): (No report).

Midwest District

Illinois (4): Ray O. Duncan; Clifford Horton; Ruth E. Lins; Jane Axtell.
Indiana (2): Robert Yoho; Karl Bookwalter.
Michigan (3): Gladys D. Ferguson; Joe Moran; Julian Smith.
Ohio (3): Edwina Jones; Paul E. Landis; Carl T. Nessley, Jr.
West Virginia (1): G. Ott Romney.
Wisconsin (2): (No report).

Northwest District

Idaho (1): (No report).
Montana (1): Inga A. Hoem.
Oregon (2): (No report).
Washington (2): Lee Rankin; Virginia L. Shaw.

Southern District

Alabama (1): Mrs. Jessie Garrison Mehling.
Arkansas (1): (No report).
Florida (2): T. J. Bleier; Louise Smith.
Georgia (2): Ernest B. Smith; Mary Ella Soule.
Kentucky (2): (No report).
Louisiana (2): (No report).
Mississippi (1): (No report).
North Carolina (2): Ruth White Fink; Charles E. Spencer.
Oklahoma (1): (No report).
South Carolina (1): (No report).
Tennessee (2): A. W. Hobt; Solon Sudduth.
Texas (3): Helen Byington; W. M. Dowell; Otho M. Polk.
Virginia (2): Harold K. Jack; Alfred D. Hurt.

Southwest District

Arizona (1): (No report).
California (4): (No report).
Nevada: (None).
New Mexico (1): John T. Gunn.
Utah (1): Elizabeth Dutton.

Affiliated Organizations

American Academy of Physical Education: Frederick W. Cozens.
American Physiotherapy Association: Esther Gilman.
American School Health Association: C. H. Keene.
American Youth Hostels, Inc.: Ben W. Miller.
Association for Physical and Mental Rehabilitation: Sam Boruchov.
Boys' Club of America, Inc.: Walter M. Hall.
Canadian Physical Education Association: A. S. Lamb.
College Physical Education Association: L. Carroll Adams.
Delta Psi Kappa: Elizabeth Moore.
National Association of Physical Education for College Women: Irene Clayton.
National Collegiate Athletic Association: Frederick W. Leuhring.
Phi Delta Pi: Mary Elizabeth McCoy.
Phi Epsilon Kappa: W. K. Streit.
Physical Education Society of the YMCA's of North America: Marshall L. Walters.
Society of State Directors of Health, Physical Education, and Recreation: Ray O. Duncan.
YWCA Health Education Directors' Society: Mary M. Weeks.